Zhifei Yao[1], Yueke Wang[1], Shumei Gao[1]

[1]Optical Information Science and Technology Department, Jiangnan University, Wuxi, Jiangsu, china

Abstract

We propose a triple band tunable and high-efficient reflected cross-polarization converter (CPC) in the mid-infrared. The study of graphene-integrated CPC becomes increasingly important, due to its tunable optical performance and small volume. Graphene, a monolayer of carbon atoms placed on a honey comb lattice, can be regarded as an emerging two-dimensional material and has drawn considerable attention due to its exceptional electrical and optical properties at terahertz and mid-infrared frequencies. So far the triple-band or multi-band polarization converters basing on graphene have been rarely reported.

We used the COMSOL Multiphysics software to demonstrate the CPC performance of our proposed. The steps are as follows: firstly, we choose the Wave optical module，and we modeled the geometric structure by appropriate value of parameters. And then, we defined the material parameters respectively. In the second place, due to that we use the x-polarized light normally incidence, we set the port type as periodic port. Turn on the wave excitation, and the electric mode field amplitude set as: E0 = (1, 0, 0). The elevation angle of incidence and azimuth angle of incidence are assumed as zero. Subsequently, we set a port mode settings as orthogonal polarization. Whereas, Floquet Periodic Boundary Condition is applied along x and y directions. Then, we use the range of frequency (30THz, 0.1THz, 60THz) to perform the parameter sweep. Finally, we mesh the structure, and we set the maximum mesh size in free space as 1/6 wavelength in electromagnetic waves setting. In mesh settings, we set the sequence type as physics-controlled mesh, and of which element size set as finer, and click the build all. All sets are complete. The result of polarization conversion can be expressed by the S parameter.

This program completes the polarization conversion function, which can be realized the x-polarized to y-polarized light conversion. In the figure, PCR can reach 96.9%, 96.2% and 83.0% at 36.15, 48.95 and 52.20THz, respectively. This work can be expected to reach Integration and miniaturization of devices. However, it is believed that our findings provide a way to manipulate the polarization and design a ultra-thin multi-band polarization converter.

Figures used in the abstract

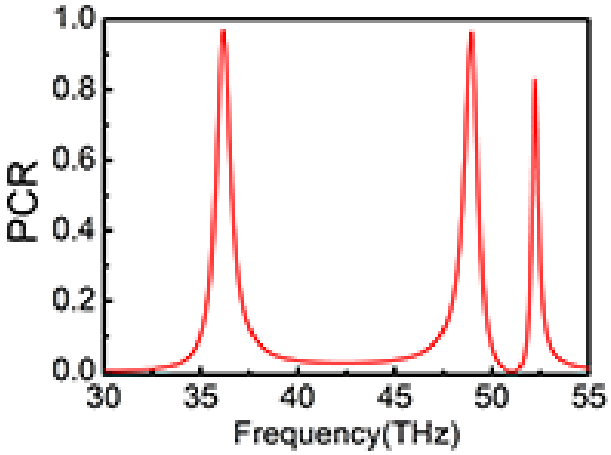

Figure 1: Triple bands(36.15, 48.95 and 52.20 THz) of cross-polarization conversion is achieved.