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Abstract

Perfect absorbers have been intensely studied in recent years because of the fundamental physics and application potentials in many areas such as cloaking, detectors or communication [1, 2]. To achieve absorber working in the terahertz (THz) range, various devices composed of noble metal or graphene have been proposed [3]. Tunability can be realized by applying gate voltage on graphene sheet in some devices. Alternately, we use magnetic field to tune the THz absorber composed of periodic gold-disks and underlying graphene sheet on dielectric/gold reflector substrate.
At certain graphene Fermi level controlled by gate voltage, the absorption peak position in reflection spectrum blue-shifts slightly from that of device without graphene sheet (around 8.9THz), as shown in Fig.1 (a). When applying a 10T magnetic field perpendicular to the graphene surface, another main absorption peak appears, which is caused by the giant imaginary part of permittivity tensor element epsilon_xx, corresponding to ohmic loss in graphene. As Fermi level of graphene increases from 0.1eV to 0.3eV, the new absorption peak in 10T magnetic field red-shifts from 14.2THz to 4.5THz, as shown in Fig.2. At fixed Fermi level, the new absorption peak blue shifts as the applied magnetic field increases. So the position of new absorption peak can be adjusted not only by gate voltage but also by magnetic field, which greatly facilitate the design and fabrication of electric and magnetic tunable THz absorbers.

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3. Amin, M., M. Farhat, and H. Bağcı, An ultra-broadband multilayered graphene absorber. Optics Express, 2013. 21(24): p. 29938.

Figures used in the abstract

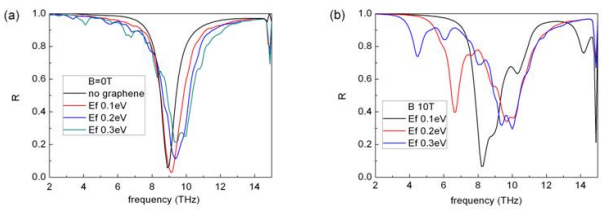

Figure 1: Figure 1. Reflection spectrum of the THz absorber at different Fermi level (a) with out magnetic field, (b) in 10T magnetic field.