Electrically tunable graphene polarization controlling

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Abstract

Polarization is a fundamental optical property of light waves and control of the polarization state of light is very useful for practical applications. Conventional methods to manipulate polarization include using natural anisotropic crystals or employing subwavelength gratings possessing artificial birefringence. In this work, we demonstrate a tunable terahertz half wave plate composed of a periodic array of two close graphene nanodisks supported on a dielectric spacer backed by a gold plane layer. We propose a polarizer with an electrically controllable polarizing direction in the far infrared range using two orthogonal periodic arrays of graphene ribbons, which have different widths and are supported on a dielectric film placed on a thick piece of metal. We also demonstrate that electrically tunable polarization beam splitting can be realized by the structure of graphene ribbons supported on a dielectric film. The investigation and explorations of polarization controlling based on graphene facilitates many practical applications and provides new possibilities for the design of novel optical devices.

References

[1] Jialong Peng, Zhihong Zhu, Jianfa Zhang, Xiaodong Yuan, Shiqiao Qin, Applied physics express, 9(2016): 55102.
[2] Z. H. Zhu, C.C. Guo, K. Liu, W.M. Ye, X.D. Yuan, B. Yang, T. Ma, Opt. Lett. 37(2012), 698 – 700 .
[3] Tang Yi-Cheng, Zhu Zhi-Hong, Zhang Jian-Fa, Guo Chu-Cai, Yuan Xiao-Dong and Qin Shi-Qiao, Journal of optics, 18(2016):025002.
[4] Z. H. Zhu, C. C. Guo, K. Liu, J. F. Zhang, X. D. Yuan, and S. Q. Qin, Journal of Applied Physics 116(2014), 104304.

Figures

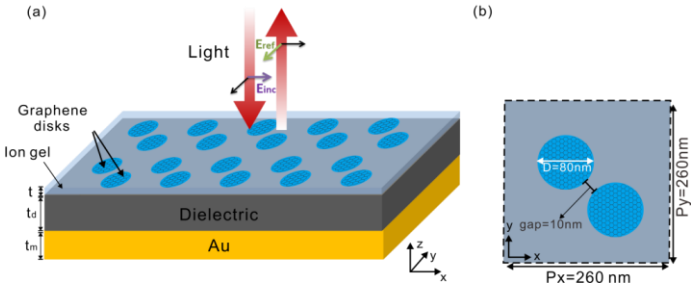

Figure 1: Arrays of the coupled graphene nanodisk dimers. (a) From the top to the bottom of the structure are an ion gel layer with a thickness of t, an array of GND, a dielectric spacer with a thickness of td, and a gold layer with a thickness of tm, respectively. b) A unit cell of GND.

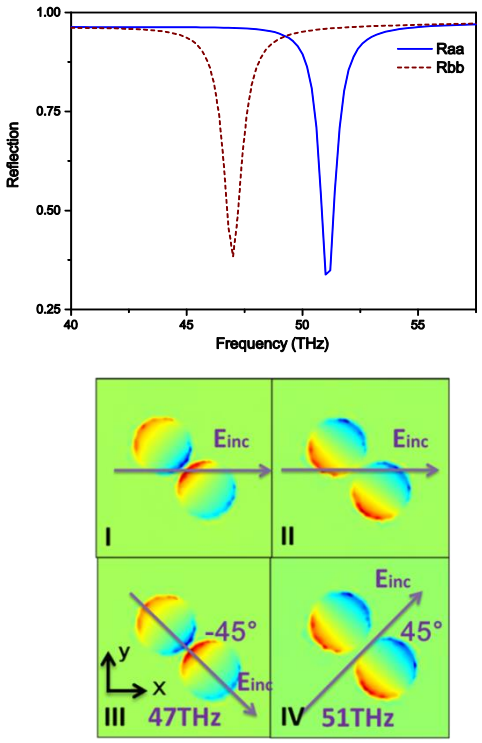

Figure 2: Reflection spectra of the incidence of polarizations of 45° and−45°; normal component of electric field (Ez) at the interface of graphene and air for the incidence of x, Ea, Eb polatozation.