International Workshop on Nanotechnology (Tnano20)
October 5 – 8, 2020, in Tbilisi, Republic of Georgia

TUNABLE GRAPHENE SPLIT-RING RESONATORS

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A split-ring resonator is a prototype of a meta-atom in metamaterials. Although noble metal-based split ring resonators have been extensively studied, to date, there is no experimental demonstration of split-ring resonators made from graphene, an emerging intriguing plasmonic material. Here, we experimentally demonstrate graphene split-ring resonators with deep subwavelength (about one hundredth of the excitation wavelength) magnetic dipole response in the terahertz regime. Meanwhile, the quadrupole and electric dipole are observed, depending on the incident light polarization. All modes can be tuned via chemical doping or stacking multiple graphene layers. The strong interaction with surface polar phonons of the SiO_2 substrate also significantly modifies the response. Finite-element frequency-domain simulations nicely reproduce experimental results. Our study moves one stride forward toward the multifunctional graphene metamaterials, beyond simple graphene ribbon or disk arrays with electrical dipole resonances only.

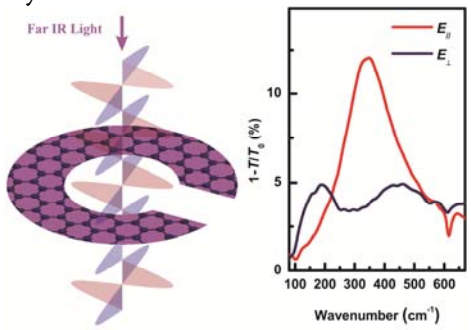

Figure 1. Split ring resonator with normal incident polarized far-infrared radiation (left), typical extinction spectra of an SRR array on Si substrate (right).

References

[1] Qiaoxia Xing, Chong Wang, Shenyang Huang, Tong Liu, Yuangang Xie, Chaoyu Song, Fanjie Wang, Xuesong Li, Lei Zhou, and Hugen Yan, Tunable Graphene Split-Ring Resonators, Phys. Rev. Applied 13, 041006 (2020).