

Dynamical tuning of graphene plasmonic resonances by ultraviolet illuminations

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Structured graphene such as graphene ribbons and disks can support interesting plasmonic resonances in the mid- and far-infrared ranges, showing many unique properties like deep subwavelength confinement, high enhancement of optical near-fields, and tunability. Among those properties, the unique features of plasmonic resonances in graphene structures is the enabled tunability through external means. Up to now, electrical gating has been extensively adopted to tune graphene plasmonic resonances. Nevertheless, the method of electrical gating has some disadvantages. To realize a dynamical tuning, graphene structures should have electrical connections. As a result, electrodes, ion-gels, or conducting substrates have to be introduced to attain an electrical connection. The method has been successfully applied to graphene sheets and ribbons. However, it is especially difficult and challenging for isolated graphene structures such as graphene disks. Moreover, intrinsic absorptions from either conducting substrates or ion-gels are inevitable, which may degrade considerably graphene plasmonic resonances. Thus, to find a way to tune plasmonic resonances in all kinds of graphene structures without the introduction of electrical connections is of great significance.

In this paper, we develop a simple and efficient method to tune graphene plasmonic resonances by UV illuminations. We show that UV illuminations can induce a dynamical tuning of plasmonic resonances in all kinds of graphene structures without introducing electrodes, ion-gel, or conducting layers required in electrical gating, which is of great significance especially for isolated graphene structures. Factors that influence this tuning process including the operating wavelength, power density, and illumination time of UV light sources are discussed. Our optical tuning method could shed new light on graphene-based tunable devices.

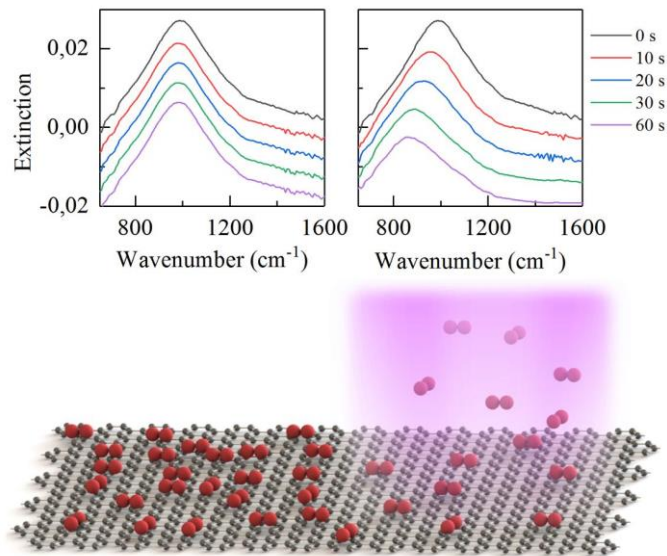


Figure: Optical tuning of plasmonic resonances in structured graphene with (upper left) and without (upper right) UV illuminations. Lower: the schematic view of the optical tuning mechanism.