Abstract:

In the present study, we experimentally demonstrate the enhancement in band edge photoluminescence (PL) of ZnO films interacted with graphene plasmon. The single- and few-layer graphene flakes were successfully prepared by micromechanical exfoliation of HOPG on top of SiO_2/ZnO film. The layer number of graphene can be typically identified by the thickness measured using AFM and Raman spectra. It was found that enhanced photoluminescence strongly depends on the surface corrugation of ZnO and the layer number of graphene. In single-layer graphene the enhancement emission of ZnO film is larger than that of few-layer graphene. Furthermore, the blue-shift in the peak position is observed upon decreasing the layer number layer of graphene. These results provide good evidence that observed remarkable enhancement can be attributed to the resonant excitation of graphene Plasmon and its transformation into propagating photons via the interaction with corrugated ZnO surface. Furthermore, there is a correlation between PL enhancement of ZnO films and the layer number of graphene. As the emission energy of ZnO match closely with the surface plasmon of monolayer graphene, it is speculated that the resonant coupling of the near band edge emission in ZnO into the surface plasmons enhances the emission efficiency. This is a new phenomenon that will motivate us to explore the optical properties of graphene and its application.