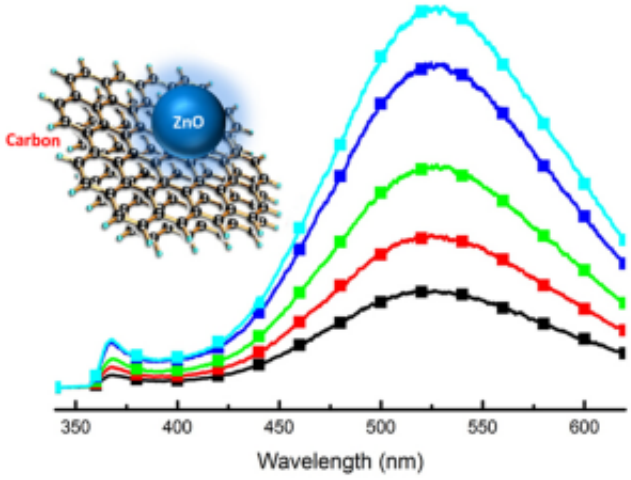
Surface plasmon effect detected in carbon nanodots

Surface plasmons (SPs) are coherent delocalized electron oscillations that exist at the interface between two materials where the real part of the dielectric has different sign across the interface, and they has versatile applications in many interesting fields, such as improving the resolution of microscopes, enhancing the sensitivity of chemical and biological sensors, increasing the quantum efficiency of light-emitting devices, killing cancerous tissues, etc. Classically, metal nanoparticles are widely employed as the arena for surface plasmon, but metal nanoparticles based surface plasmon usually has relatively large optical loss, which impairs the applications of surface plasmon drastically. It has been reported that highly doped semiconductors can also serve as the arena for surface plasmon, but such surface plasmons can usually only cover the infrared region. Nowadays, graphene has been demonstrated the ability to provide surface plasmons in various spectrum regions ranging from ultraviolet to infrared, and the resonance peaks can be tuned by doping or regulating the sizes of graphene nanostructures.



As an emerging carbon based nanostructures, carbon nanodots have been a research focus in recent years for their high luminescent efficiency, tunable emission, and good bio-compatibility, etc. Because of the above characters, carbon nanodots have great potential applications in light-emitting devices, bio-imaging and labeling, etc. As carbon nanodots are complex carbon nanomaterial with a mix of amorphous carbon and graphite carbon, the graphite part is supposed to support carbon nanodots working for surface plasmonic resonance. However, none such report can be found to date. In a recent work carried out by researchers from Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences and Zhengzhou University, it is reported that the fluorescence of ZnO quantum dots (QDs) solution can be enhanced greatly, meanwhile the lifetime of the fluorescence is decreased significantly, by introducing carbon nanodots, and the above phenomenon has been attributed to the surface plasmon effect of the nanodots. This is the first report on surface plasmon effect from carbon nanodots, thus may open another potential application area for carbon nanodots and rich the family of surface plasmon as well.

Publication

Surface plasmon effect of carbon nanodots.
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