**Luminol Chemiluminescence Enhancement in the Presence of Colloidal Plasmonic Nanoparticles**

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Chemiluminescence is a fascinating optical effect which was used about five decades ago to analyse a crime scene using luminol molecule. Luminol is a chemical which exhibits chemiluminescence emission of bluish colour when oxidized. It was shown, that plasmonic nanoparticles enhance and prolong the glow of luminol. This effect was interpreted in terms of the Purcell effect mediated by localized surface plasmons [1].

Here, we explore the noble metallic nanoparticles which possess the possibility of excitation of surface plasmon-polaritons due to collective oscillations of the conduction band electrons to efficiently enhance the chemiluminescence effect. High localization of plasma fields of metallic nanoparticles as a local surface plasmon resonance makes it possible to tune the quality factor (Q) of the plasmonic resonance in such a way that the resonant absorption of plasmons overlaps with the emission of luminol.

Using COMSOL Multiphysics®, we numerically explored the resonant absorption of nanoparticles varying in diameter between d=20-60 nm. We found, that when d=40 nm width has highest weight which is 24%, d=20 nm has the lowest weight which is 14%, compared to other sizes of nanoparticles their collective resonant absorption response overlaps with the emission spectra of the luminol when Q of the collective response was reduced.

We fabricated the nanoparticles using the laser ablation technique in an aqueous colloidal solution. We found that the colloidal solution of silver nanoparticles has indeed the distribution in size of nanoparticles ranging from d=20-60 nm in diameter when the laser energy is of 98.6 mJ while ablating during 15 minutes.

Low Q of plasmonic resonance is crucial for the efficient interaction between the nanoparticle acceptors and the luminol donors in which they spectrally overlap.

References

1. Karabchevsky, A., Mosayeebi, A., Kavokin, A.V.. 'Tuning the chemiluminescence of a luminol flow using plasmonic nanoparticles', Light Sci Appl. 5, e16164, (2016).