

Modification of the Photonic Properties of Cyanine Thin Films by Near Fields of Plasmonic Nanostructures

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Excitation of the surface plasmons localized in the metal nanoparticles are known to lead to the huge enhancement of their near fields. This property is well documented in the current theoretical papers. Enhancement of the field contributes to the well-known surface enhanced Raman scattering (SERS), which is the basis of novel chemical and biological sensors. One of exotic applications is the first in the world nanolaser based on gold nanoparticles and dye molecules.

Thus it is known that the presence of the noble metal nanoparticles can modify the photonic properties of the solutions of organic dyes. But the solid-state structures of organic molecules and metal nanoparticles are needed in the majority of applications. For example it can be used for developing the thin-film solar cells and the OLED-displays. This scientific and technological direction is novel because the first papers about such solar cells and OLEDs based on plasmonic nanostructure were published only in last 2–3 year.

Despite the studies that have been carried out, the mechanism of the changes in absorption and fluorescence spectra has not been definitively explained. The situation with ensembles of metallic nanoparticles formed on the surface of transparent dielectric substrate during physical thermal deposition is especially complex. Because of the relative simplicity, this method of producing plasmonic nanoparticles is useful for applications. At the same time, it has such disadvantages as significant variation in the shape of the produced nanoparticles. An additional difficulty in interpreting the results of experiments with organic thin films on dielectric substrates is the broadening of the absorption spectra of dye film in comparison with dye solutions is due to formation of different molecular forms, even when there are no metallic nanoparticles on the substrate. So we studied the dependence of the fluorescence enhancement of organic molecules in the near field of plasmon nanoparticles. , and also on the distance between the components was studied experimentally. Therefore we studied the influence of metallic nanoparticles on the absorption and fluorescence of molecular forms formed in hybrid planar nanostructures. Also the dependence of the photonic properties were experimentally determined depending on the distance between the molecules and particles.