Nanoplasmonics and surface enhanced spectroscopy

Fluorescent sensitivity of TiO_2:Sm^{3+}-Au films to the oxygen

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Monitoring of oxygen concentration is important for many applications, such as preventing formation of explosive fuel-air mixtures, monitoring food quality, providing appropriate respiratory conditions in an industrial environment. The scientific and applied relevance of the optical oxygen sensing, based on the effect of quenching organic dye luminescence, has been recently reviewed [1].

More recently, several materials, in which oxygen does not quench, but enhances the fluorescence, have been found. The process is taking place at room temperature under photostimulation. Our group showed that TiO_2:Sm^{3+} fluorescence under ultraviolet excitation became stronger in the presence of oxygen [2]. It is possible that the excitation efficiency is increased or radiative lifetime of Sm^{3+} is prolonged by oxygen presence.

Recently it was revealed that the fluorescence of TiO_2:Sm^{3+} composite films with gilded nanoparticles can be enhanced further in the vicinity of nanoparticles [3]. In this report we shall discuss the possibility of plasmon-exciton coupling in this system. Micro-spectroscopic study of the system revealed that the saturated character of fluorescence became more pronounced in the vicinity of the gold nanoparticles. This work is supported by Estonian Science Agency (institutional project IUT34-27) and partially by NATO SFP 984702 project and Marie Curie ILSES project no. 612620.

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