IN-001 <Invited Talk>

Plasmonic Nanosheet towards Biosensing Applications

Kaoru Tamada

Institute for Materials and Engineering, Kyushu University

Surface plasmon resonance (SPR) is classified into the propagating surface plasmon (PSP) excited on flat metal surfaces and the local surface plasmon (LSP) excited by metalnanoparticles. It is known that fluorescence signals are enhanced by these two SPR-fields.On the other hand, fluorescence is quenched by the energy transfer to metal (FRET). Bothphenomena are controlled by the distance between dyes and metals, and the degree offluorescence enhancement is determined by the correlation. In this study, we determined thecondition to achieve the maximum fluorescence enhancement by adjusting the distance of ametal nanoparticle 2D sheet and a quantum dots 2D sheet by the use of SiO_2 spacer layers.

The 2D sheets consisting of myristate-capped Ag nanoparticles (AgMy nanosheets) wereprepared at the air-water interface and transferred onto hydrophobized gold thin films basedon the Langmuir-Schaefer (LS) method [1]. The SiO_2 sputtered films with different thickness (0～100 nm) were deposited on the AgMy nanosheet as an insulator. TOPO-cappedCdSe/CdZnS/ZnS quantum dots (QDs, λ_{Ex}=638 nm) [2] were also transferred onto the SiO2 films by the LS method. The layered structure is schematically shown in Fig. 1.

The result of fluorescence measurement is shown in Fig. 2. Without the SiO_2 layer, the fluorescence intensity of the layered QD film was lower than that of the original QDs layer, i.e., the quenching by FRET was predominant. When the SiO_2 thickness was increased, the fluorescence intensity of the layered QD film was higher than that of the original QDs layer, i.e., the SPR enhancement was predominant. The fluorescence intensity was maximal at the SiO_2 thickness of 20 nm, particularly when the LSPR absorption wavelength (λ=480 nm) was utilized for the excitation. This plasmonic nanosheet can be integrated intogreen or bio-devices as the creation point ofenhanced LSPR field.

References

[1] Toma, M. et al. Phys. Chem. Chem. Phys. 13, 7459 (2011).

[2] Lim, J. et al, Adv. Mater., 19, 1927 (2007).

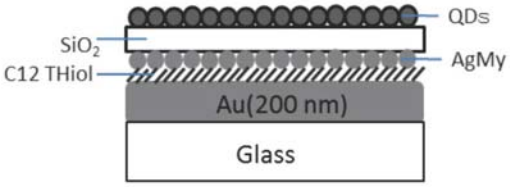

Fig.1 Layered structure composed of AgMy and QDs nanosheets with SiO_2 spacer layer.

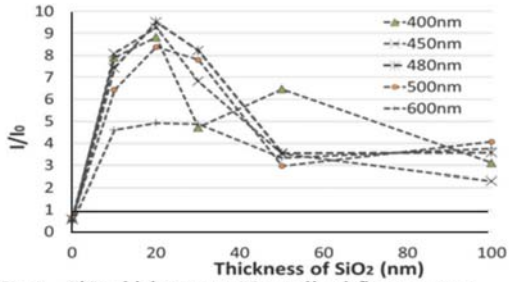

Fig.2 SiO_2 thickness vs. Normalized fluorescence intensity (I/I_0).