PLASMON-ENHANCED UPCONVERSION LUMINESCENCE USING SPRAY-ASSISTED LAYER-BY-LAYER DEPOSITION

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MOTIVATION Metal nanostructures located in close proximity to upconversion nanoparticles (UCNPs) act as nanoantennae for efficiently concentrate the excitation field around the UCNP. However, if the UCNP is too close to the metal surface, its fluorescence could be quenched[1]. Thus, different plasmonic upconversion luminescence architectures in which UCNP-metal distance is tailored carefully have been developed but their fabrication is often quite complex and needs expensive equipment[2-3]. Here, we propose a simple and low-cost method to fabricate hybrid systems with UCNPs and gold nanorods (AuNRs) based on spray-assisted layer-by-layer deposition.

RESULTS We use AuNRs with their longitudinal surface plasmon resonance matching the excitation wavelength of the UCNPs. The distance between the UCNPs and the AuNRs is controlled by successively spraying different polyelectrolyte bilayers of polyallylamine hydrochloride (PAH) and polystyrene sulfonate (PSS) (Fig. 1(left panel)). We found upconversion emission enhancement up to 3 times for spacer thickness of around 8 nm (Fig. 1 (right panel)).

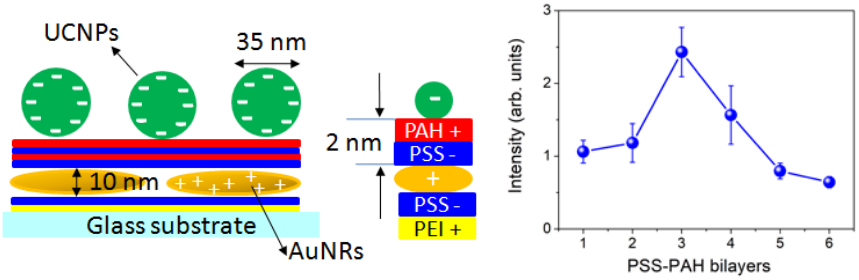

Figure 1. Scheme of the plasmon-enhanced luminescence nanostructured system (left panel). Fluorescence intensity as a function of the distance between the surface of the UCNPs and the AuNRs (right panel).

CONCLUSIONS We use a low-cost and very simple fabrication method based on spray-assisted layer-by-laser deposition to fabricate a plasmon-enhanced hybrid system of UCNPs and AuNRs. This simple system allowed us to increase by a factor of three the intensity of upconversion luminescence.

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