Plasmon-induced thermal activation of sensitizer/emitter energy transfer in triplet annihilation-based upconversion system

([1]*Graduate School of Science and Technology , Nihon University*, [2]*Collage of Science and Technology, Nihon University*) ○Akira Yamada,[1] Riku Watanabe,[2] Kosuke Sugawa,[2] Joe Otsuki[2]

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Triplet annihilation-based upconversion is an optical wavelength conversion technology, and one of the problems is significant energy loss due to the multiple energy transfer processes. In particular, the intermolecular energy transfer between the sensitizer/emitter disturbs the expansion of the anti-stokes shift. While the problem is being tried by various approaches,[1,2] the efficiency was significantly improved utilizing the photothermal conversion by localized surface plasmon resonance (LSPR) of metal nanoparticles in this study. A TEM image of Au nanorods (AuNRs) used as a plasmonic nanoparticle is shown in Fig. 1. The length of AuNRs was estimated to be 28 ± 6 nm. The extinction spectrum (Fig. 2(a)) of hybrids of AuNRs with polymer film containing Pd(Ⅱ) tetraphenyl tetrabenzoporphyrin (sensitizer) and 9,10-diphenylanthracene (emitter) showed a prominent extinction band (longitudinal mode) at 1060 nm. The emission spectra of the hybrids are shown in Fig. 2(b). The upconverted emission was increased with increasing the power of the 1060 nm laser. These results suggest that the local heat generated through the LSPR excitation of AuNRs greatly improved the sensitizer/emitter upward energy transfer.

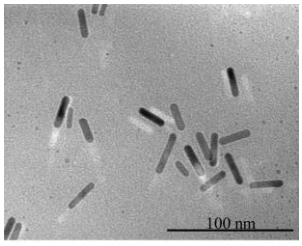

Fig. 1 TEM image of AuNRs.

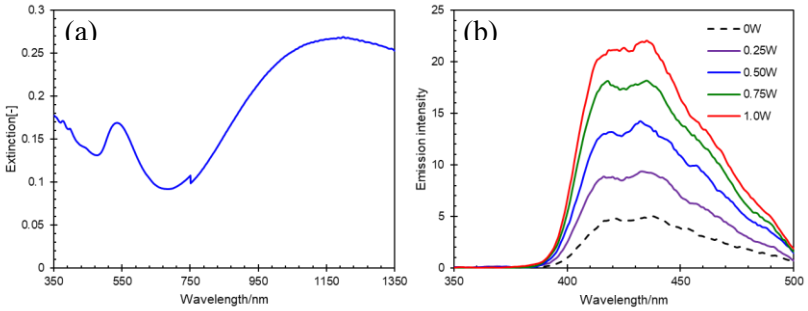

Fig. 2 (a) Extinction spectrum of hybrid and (b)upconverted emission (λ_{ex} = 635 nm) spectra of hybrids with changing the power of assist laser with 1060 nm.

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