Optimal selection of sensitizer for plasmon-enhanced triplet annihilation-based upconversion systems

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Keyword: Triplet-triplet annihilation; Localized surface plasmon resonance; Pd(II) tetraphenyl tetrabenzoporphyrin; Pt(II) tetraphenyl tetrabenzoporphyrin

Among various upconversion technologies, triplet-triplet annihilation-based upconversion (TTA-UC), which can be driven by low-density light, is useful. However, its performance is still developing. We reported the conflicting effects of quenching and enhancement of TTA-UC emission by the localized surface plasmon resonance (LSPR).[1)] The purpose in this study is to clarify the difference between the sensitizers in the TTA-UC systems affected by the LSPR.

Triangular silver nanoprisms (AgPRs, TEM image: Fig. 1(a)) were hybridized with the composite films of sensitizers (Pd(II) and Pt(II) tetraphenyl tetrabenzoporphyrin: Pd-TPTBP and Pt-TPTBP) and an emitter (bis(phenylethynyl)anthracene: BPEA). The LSPR band was overlapped with the excitation wavelength of TTA-UC. The major difference between the two sensitizers was triplet-excited sensitzer/emitter intermolecular energy transfer efficiency. The efficiency, which was calculated by 1- (phosphorescence with emitter/that without emitter), was significantly decreased for the systems using Pt-TPTBP, rather than Pd-TPTBP. This difference implies that the optical interaction between the triplet-excited sensitizer and the LSPR differs, depending on the metal center.

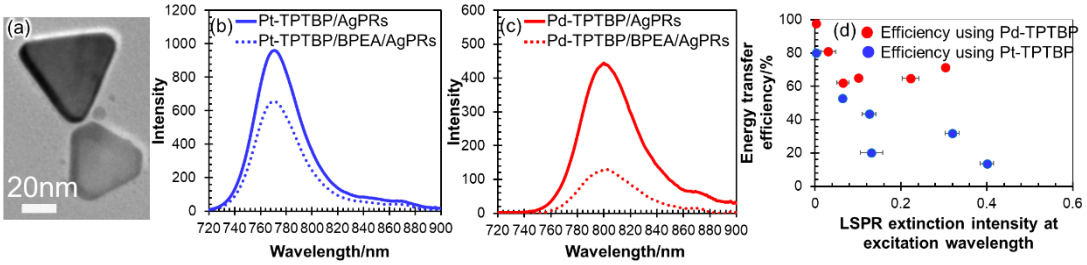

Fig. 1. (a) TEM image of AgPRs. (b) and (c) Phosphorescence spectra for hybrids of AgPRs and TTA-UC with and without emitter. (d) Calculated energy transfer efficiency.

Acknowledgment: this work was supported by a Grant-in-Aid for Scientific Research(B) (grant no. 20H02850) from JSPS KAKENHI.

Reference: 1) S. Jin et al., *ACS Photonics*, **2018**, *5*, 5025.