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Photophysical characterization of solid-state, near-infrared to visible triplet-triplet annihilation photon upconversion

Dr. Aizitiaili Abulikemu

Innovation Center for Organic Electronics, Yamagata University

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場 所：東京大学理学部1号館2階201b講義室

Abstract

Solid-state triplet-triplet annihilation photon upconversion (TTA-UC) have attracted considerable attention in recent years because of its superior capability of converting the two low-energy photons into a high-energy photon under sunlight level excitation intensity. In our previous work, we successfully realized solid-state TTA-UC from green (532 nm) to blue (430 nm) wavelength region by the rapid-drying casting method [1]. In order to improve the efficient utilization of solar radiation, we challenge to the near-infrared-to-visible (NIR-to-Vis) conversion in binary solid by applying the same approach.

In this study, the TTA-UC from NIR (785 nm) to visible (yellow, centered at 570 nm) regions has been demonstrated in the binary solid of condensed chromophores. Microparticles of the binary solid comprising rubrene as a matrix (emitter) and π-extended Pd-porphyrin as a dopant (sensitizer) in a mole ratio of 1000:1 were obtained by solution casting. Excitation intensity dependence and quantum yield (QY) of the upconverted emission were characterized for individual particles under a microscope and revealed a low threshold intensity (~100 mW/cm^2) as compared to the solution and moderate UC-QY (~0.5%) in the NIR range. The factors contributing to the UC-QY were investigated by time-resolved and steady-state spectroscopies. It was found that the intersystem crossing of the sensitizer, triplet energy transfer, and TTA occurred efficiently in the binary solid, and the fluorescence QY of the emitter governed the UC-QY [2].

Details including fabrication methods and characterization of each photophysical processes will be explained in the presentation.

References : [1] K. Kamada, *et al*. *Mater. Horiz.* **2017**, *4*, 83. [2] A. Abulikemu, *et al*. *ACS Applied Materials & Interfaces (accepted).* **2019.**

使用言語 ： 英語
紹介教員 ： 湯本潤司 教授（理学系研究科物理学専攻）
本件連絡先 ： psc-office@psc.t.u-tokyo.ac.jp