Laboratoire PPSM – UMR CNRS 8531

Photochimie et Photophysique Supramoléculaires et Macromoléculaires

Séminaire PPSM

Lundi 2 Octobre 2017 - 14h00

Auditorium D. Chemla - Bâtiment IDA

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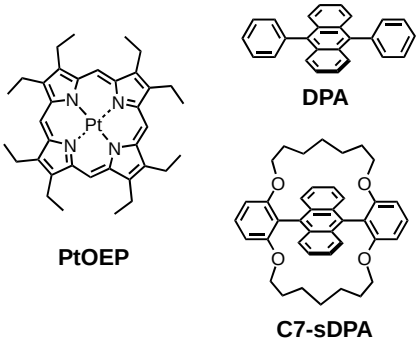
Invité par : Pierre Audebert

«Efficient photon upconversion with a new emitter: from solution to binary solid fabricated by casting»

Photon upconversion based on the triplet-triplet annihilation mechanism (TTA-UC) has been attracted considerable attention for the last several years because of its high quantum yield at low excitation intensity close to sunlight. For TTA-UC, two molecular species are needed: one is “sensitizer” absorbing the light and generate its triplet state with high quantum yield and the other is “emitter” whose triplets interact each other though TTA process and generate its excited singlet emitting a photon as delayed fluorescence. Among various combinations of the sensitizers and emitters, the pair of Pt-octaethylporphirin (PtOEP, sensitizer) and 9,10-diphenylanthracene (DPA, emitter) has been known to show one of the highest upconversion quantum yield (UC-QY), providing green(532 nm)-to-blue(430nm) upconversion. We have introduced the new emitter molecules having loop-like alkyl chains to cover the diphenylanthracene core (C7-sDPA, Fig. 1). This emitter showed higher UC-QY than its parent molecule in solution. The process contributing to the high UC-QY is discussed. Furthermore, TTA-UC in solid system, important for device applications, is presented with the molecules. Previously, UC-QY was very limited in solid system because of the triplet energy transfer (TET) process was limited due to segregation of sensitizer from the emitter matrix. We developed “rapid-drying casting” method where the matrix of emitter solidified faster than the segregation of sensitizer molecules. The binary sold fabricated by this method showed excellent upconversion properties. Especially, with C7-sDPA, the low excitation intensity at the sunlight level and UC-QY around 20% was successfully achieved. The results show that this approach is a promising method for developing efficient solar photon upconverter.

sensitizer emitter



DPA

PtOEP

C7-sDPA

[1] K. Kamada, et al., Mater. Horiz., 2017, 4, 83.

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