Solid-state Triplet-triplet Annihilation Upconversion System by Using Aggregation-Induced Emission Acceptor

Yi Li[1,2], Yi Zeng[1,2], Li Li[1,2]

[1] *Key Laboratory of Photochemical Conversion and Optoelectronic Materials, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, China*

[2] *University of Chinese Academy of Sciences, Beijing 100049, China*

E-mail: yili@mail.ipc.ac.cn

Photon upconversion, which refers to converting photons of lower energy to those of higher energy, has attracted much attention because of its potential applications in photovoltaics, bioimaging, displays, and photodynamic therapy (PDT). Triplet-triplet annihilation upconversion (TTA-UC) is at the forefront of upconversion in recent years, because TTA-UC can take place upon excitation with low-intensity, noncoherent light source and the upconversion emission wavelength can be tuned by simply molecular tailoring. TTA-UC involves a bimolecular system consisting of sensitizers and acceptors, and its efficiency is affected not only by the TTA processes and fluorescence quantum yield of acceptors, but also by the triplet production and the triplet-triplet energy transfer which are deeply depended on the properties of triplet sensitizers. It is of great importance for practical applications to develop efficient TTA upconversion systems not only in solution but also in solid states. Application of the TTA upconversion systems is hampered by a concentration-induced quenching. This can be overcome by introducing chromophores capable of efficient emission in aggregated states, so-called “aggregation-induced emission” (AIE). In this presentation, the recent experimental findings in our group on the TTA-UC systems, especially on the solid-state one will be discussed. The AIE chromophores have been used as the triplet energy acceptor, and a solid-state TTA upconversion system is obtained by doping in the nanocrystals of acceptors, giving an efficient red-to-green upconversion with a peak quantum yield of 0.3%. This study may provide promising strategy for constructing practical TTA-UC systems.

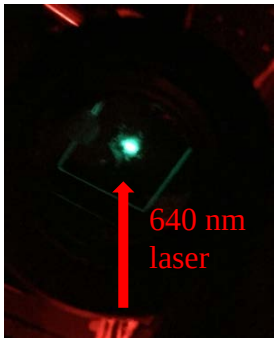

Figure 1. Image of the solid-state upconversion taken through a 515 nm short-pass filter upon 640 nm excitation.

Funding: 973 Program (2013CB834703) and NSFC (21673264, 21573266, 21233011)