TIPS-NPH AND IRIDIUM COMPLEX SYSTEM FOR PHOTON UPCONVERSION FROM VISIBLE LIGHT TO UV

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Certain photocatalytic reactions, such as those involved in wastewater treatment and water splitting, demand the use of high-energy UV photons. Nevertheless, the deficiency of natural sunlight intensity in the UV region and the suboptimal efficiency and limited lifespan of artificial light sources pose significant challenges. Moreover, photochemical catalysis applications like laser 3D printing necessitate the concentration of energy at a specific point, circumventing any material between that point and the light source. A potential resolution to these issues is the implementation of Vis-to-UV photon upconversion (UC).

In our investigation, we explored a UC system comprising the annihilation properties of 1,4-Bis((triisopropyl silyl)ethynyl)naphthalene (TIPS-Nph) and the sensitizing capabilities of an iridium complex (Ir-C). Initially, the fluorescence quantum yields (QY) of TIPS-Nph solutions were measured. These measurements yielded promising results, with a QY reaching 53.5%. While solutions are impractical for real-world applications, subsequent measurements of drop-casted TIPS-Nph films proved encouraging. Emitter concentration optimization in films with a polystyrene matrix demonstrated a fluorescence QY as high as 44%.

Encouraged by these standalone emitter results, we prepared solutions incorporating the Ir-C sensitizer. Two solutions with a 0.1mM sensitizer to 1mM emitter and then a 10mM concentration ratio achieved UC-QY of 2.8% and 3.2%, respectively. However, drop-casted films with 0.5% (weight) sensitizer and varying emitter concentrations for optimization in polystyrene matrix showed no photon upconversion. Presence of impurities was determined in the emitter which was likely to cause lack of upconversion in the films.