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Time-Resolved Spectroscopy Studies to Understand Aggregation Induced Emission Properties and Phenomena

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Abstract

The aggregation-induced emission (AIE) phenomenon was firstly reported by the Tang group in 2001, which has revolutionized the scientific fields of biological and optoelectronic materials in the past two decades. Due to importance of AIE, thousands of work has been published on developing the new efficient AIE luminogens (AIEgens) and implement the practical

Fig. 1: fs-TA spectra of the TPE in MECN (left), proposed nonradiative mechanism (right).

applications. Though the conical intersection, E/Z isomerization, proton transfer, charge transfer, intra- and inter molecular restrictions has been considered as the main reasons for the phenomenon of AIE systems, few direct evidence have been found to support those hypotheses.

The time-resolved spectroscopy techniques are considered as the powerful techniques for studying and characterizing the mechanism of AIE materials. The transient absorption and time-resolved resonance Raman have been employed to study a number of TPE-based derivatives with varying structural rigidity and AIE properties. The direct correlation between the state-dependent coupling motions and inhibited fluorescence, and prove the existence of photocyclized intermediates have been studied. We demonstrate that the dominant non-radiative relaxation dynamics *i.e.* formation of intermediate or rotation around the elongated C=C bond, is responsible for the AIE effect, which is strongly structure-dependent but not structural rigidity related. Besides, the femto second transient absorption was also employed to prove the the excited state aromaticity inversion for the non-aromatic annulene derivative of cyclooctatetraene which shows typical AIE phenomenon in spite of its rotor-free structure. Therefore, study the photophysical and photochemical mechanisms of AIEgens will be instructive to guide tailoring for the develop of more efficient luminogens.

Keywords: fs-TA, TPE, Aggregation induced emission, ultrafast, transient species