Heterocycle-based luminogens with aggregation-induced emission characteristics

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Aggregation-induced emission (AIE) is a new concept—the term was coined by Ben Zhong Tang of the Hong Kong University of Science & Technology (HKUST) in 2001, and refers to a unique photo-physical phenomenon in which some nonplanar-shaped luminogens emit faintly in their dilute solutions, but show remarkably enhanced luminescence upon aggregation. The AIE is exactly opposite to the notorious aggregation-caused quenching (ACQ) effect, which has been regarded as a general phenomenon for conventional fluorophores. The AIE could enable the luminogens to perform best in their condensed phases, and has thus drawn much interests among researchers worldwide.

Based on tremendous experimental and theoretical studies, restriction of intramolecular motion (RIM) has been rationalized as the cause for AIE effect. Under the guidance of the RIM mechanism, hundreds of AIE-active luminogens (AIEgens) have been successfully designed and prepared, and interesting applications superior to the ACQ fluorophores in optoelectronic and biological fields have been well demonstrated.

However, in comparison with the mostly reported hydrocarbon AIEgens, the heterocycle-based ones that contain the hetero-atoms of silicon, nitrogen, sulphur, phosphorus, or boron etc. are rarely reported, probably due to the synthetic difficulties. The introduced heteroatoms will furnished the AIEgens with lots of advantages, such as improved electron- or hole-transportation capacity, tunable energy gap and structures in designing redder emissive and nonlinear optical materials, which are crucial for their applications in optoelectronic devices, chemo-

and bio-sensors, and bioimaging, etc.

To provide the researchers with a whole picture of heterocycle-based AIEgens, Qin, Tang and coworkers have published a summary of their progress in the past decade in the *Chinese Science Bulletin* (2016, 61, 304-314). It is worth noting that besides discussing early reported silole-based AIEgens, the authors introduced their newly developed AIE core of tetraphenylpyrazine (TPP). TPP enjoys the advantages of simple preparation, easy post-functionalization, high thermal and photo-stability, etc. Moreover, the pyrazine moiety might improve the electron affinity of the TPP and its derivatives.

At the end of the review, the authors also discussed the challenges and opportunities for the further development of heterocycle-based AIEgens. They believe that with the enthusiastic efforts paid by the researchers worldwide, more and more heterocycle-based AIE systems will be generated that will not only enrich the AIE family but also prompt their multifaceted applications in optoelectronic and biological fields.

More information: Ming CHEN et al. Progress on heterocycle-based luminogens with aggregation-induced emission characteristics, *Chinese Science Bulletin (Chinese Version)* (2016). DOI: 10.1360/N972015-00760

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