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Pyridine-N-oxide Based AIE-active Triazoles: Synthesis, Morphology and Photophysical Properties

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Abstract : Aggregation induced emission (AIE) is an intriguing optical phenomenon recently evidenced by Tang and his co-workers, for which aggregation works constructively in the improving of light emission. The AIE challenging phenomenon is quite opposite to the notorious aggregation caused quenching (ACQ) of light emission in the condensed phase, and comes in line with requirements of photonic and optoelectronic devices which need solid state emissive substrates. This paper reports a series of ten new aggregation induced emission (AIE) low molecular weight compounds based on triazole and pyridine-N-oxide heterocyclic units bonded by short flexible chains, obtained by a „click" chemistry reaction. The compounds present extremely weak luminescence in solution but strong light emission in solid state. To distinguish the influence of the crystallinity degree on the emission efficiency, the photophysical properties were explored by UV-vis and photoluminescence spectroscopy in solution, water suspension, amorphous and crystalline films. On the other hand, the compound morphology of the up mentioned states was monitored by dynamic light scattering, scanning electron microscopy, atomic force microscopy and polarized light microscopy methods. To further understand the structural design – photophysical properties relationship, single crystal X-ray diffraction on some understudy compounds was performed too. The UV-vis absorption spectra of the triazole water suspensions indicated a typical behaviour for nanoparticle formation, while the photoluminescence spectra revealed an emission intensity enhancement up to 921-fold higher of the crystalline films compared to solutions, clearly indicating an AIE behaviour. The compounds have the tendency to aggregate forming nano- and micro- crystals in shape of rose-like and fibres. The crystals integrity is kept due to the strong lateral intermolecular forces, while the absence of face-to-face forces explains the enhanced luminescence in crystalline state, in which the intramolecular rotations are restricted. The studied flexible triazoles draw attention to a new structural design in which small biologically friendly luminophore units are linked together by small flexible chains. This design enlarges the variety of the AIE luminogens to the flexible molecules, guiding further efforts in development of new AIE structures for appropriate applications, the biological ones being especially envisaged.

Keywords : aggregation induced emission, pyridine-N-oxide, triazole
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