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NEW ORGANIC ENERGY DONOR-ACCEPTOR SYSTEM FOR SOLUTION-PROCESSABLE LUMINESCENT THERMAL INDICATORS

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Organic molecules exhibiting so-called excited state intramolecular proton transfer (ESIPT) have demonstrated unique fluorescent properties, including dual-emission and large values of Stokes shift [1]. However, their application in thin films and related technologies is limited and mainly focused on the realization of efficient white light organic light-emitting diodes (WOLEDs) [2]. In the frame of exploring new applications for ESIPT compounds, we have designed and synthesized two benzothiazole isomers with tailored optical properties in thin films.

First, we have demonstrated that tuning of fluorescence emission wavelength and fluorescence quantum yield for those compounds resulted from modified (inter)molecular interactions in thin films. The latter were achieved by optimization of several parameters, including selection of solvent used for deposition and by studying the effect of the annealing temperature [3]. Basing on this approach, we have also elaborated more advanced materials in form of thin films incorporating ESIPT molecules. It was achieved by doping the ESIPT analogues with a novel far-red fluorescent dye, thus realizing organic Förster resonance energy transfer (FRET) systems. We have explored the role of their molecular interactions by studying their morphology and fluorescent properties. Such analysis enabled us to develop unique temperature indicators based on FRET mechanism. The developed temperature indicators are air-stable, capable of detecting multiple temperature ranges, and compatible with naked eye inspection under UV illumination. Finally, the application of thin films as thermal indicators was demonstrated for simple visual inspection and for ratiometric sensing, showing noticeable color changes every 20 ℃ and remarkable sensitivities of up to 14 % ℃-1 [4].

References:
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