

In Search of High-Performance Scintillators: TADF-Based Organic Materials

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In response to the increasing interest in fully organic scintillation materials [1-3], we investigated a series of compounds based on thermally activated delayed fluorescence (TADF) emitters, including DMAC-TRZ with its derivatives DMAC-diF-TRZ, DMAC-diCl-TRZ [4] and diBr-DMAC-diCl-TRZ, as well as PXZ-TRZ and PXZ-dSP-TRZ. These materials were designed with the aim of enhancing the efficiency of the $T_1 \rightarrow S_1$ reverse intersystem crossing, which is a key factor governing their luminescence performance.

All compounds were studied in the form of single crystals grown by the slow solvent evaporation method. Their basic scintillation properties were examined using pulse height and scintillation time profile measurements. X-ray excited radioluminescence spectra were recorded as a function of temperature between 10 and 350 K. In addition, low-temperature thermoluminescence following X-ray irradiation was investigated in the same thermal range.

The collected data enable a comparative analysis of the aforementioned materials in terms of their scintillation characteristics. The study provides thus an insight into the potential of TADF-based systems as fully organic scintillators and indicates some directions for further material optimization.

[1] Ma W. et al. (2022), *Nat. Mater.*, 21, 210-216.

[2] Maddalena F. et al. (2019), *Cryst.*, 9, 88/1-29.

[3] Zhao M. et al. (2025), *J. Mater. Chem. C*, 13, 5424-5438.

[4] Patent application no. P.448129 submitted to the Polish Patent Office on 28.03.2024.

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