

Towards white fluorophores: synthesis and luminescence of substituted phthalide-based donor-acceptor conjugates

Paweł Gawryś¹, Elena Karpiuk¹, Jerzy Karpiuk¹

¹Polish Academy of Sciences, Institute of Physics, Al. Lotników 32/46, 02-668 Warsaw, Poland

E-mail: pgawrys@ifpan.edu.pl

Emission of white light by a single molecular system is a highly desired phenomenon due to prospective applications in displays or light emitting devices. White fluorophores are compounds which display broad fluorescence over the entire visible range (e.g., 430-700 nm). One approach to obtain white light from a molecule is to make use of dual fluorescence displayed as a balanced combination of the emission from a locally excited (LE) and a charge (CT) or proton transfer (PT) states. The prototype example (Crystal Violet Lactone, CVL) emits a blue band from an LE state and an orange band from a highly polar CT state identified as intramolecular exciplex. [1] The observed photoluminescence spectrum and photostability are greatly affected by the substitution pattern of the electron donating (D) and accepting (A) parts (Figure 1).

Recently we have found that the CVL-like structure with D and A subunits linked by an sp^3 carbon is a versatile platform for white fluorophores, and for a series of CVL derivatives it is possible to achieve white-like photoemission in solution. The purpose of the present study was to explore the best synthetic routes to different luminophores of the phthalide series (Figure 1) and to examine their luminescence behavior in solution as a function of Z, X, R substituents and solvent polarity and temperature. The simplest CVL analogues (e.g., $Z=NR_2$, $X=H$) are easily synthesized in a condensation reaction between 3-dialkylaminobenzoic acid and 4-dialkylaminobenzaldehyde, but in spite of the emission pattern resembling that of CVL they are not photochemically stable due to benzylic hydrogen at the spiro carbon. Therefore novel systems with ($X=alkyl$, $Z=NR_2$) were prepared whose observed photostability in solution was greatly improved.

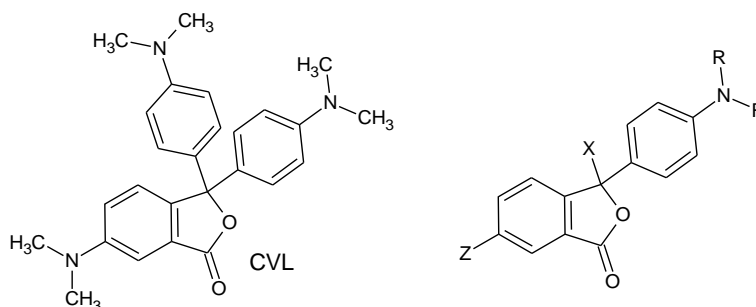


Figure 1. The general structure of fluorophores studied in this work.

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References:

[1] J. Karpiuk, E. Karolak and J. Nowacki, *Phys. Chem. Chem. Phys.*, **2010**, 12, 8804-8809.