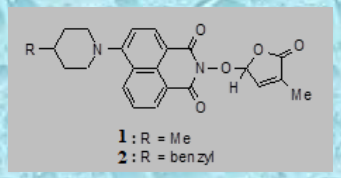
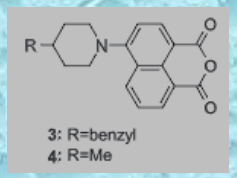
Photophysical Properties of some Naphthalimide Derivatives

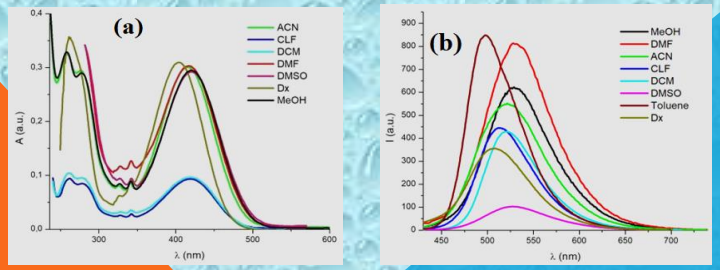
Ionut Radu Tigoianu[1], Anton Airinei[1], Florentina Georgescu[2], Alina Nicolescu[1], Calin Deleanu[1]

[1] "Petru Poni" Institute of Macromolecular Chemistry, 41A Gr. Ghica Voda Alley, 700487 Iasi, Romania
[2] Enpro Soctech Com srl, Str. Elefterie 51, 050524 Bucharest, Romania





Naphthalimide derivatives have many interesting properties such as strong emission, high quantum efficiency, good photostability, thermal stability, etc.

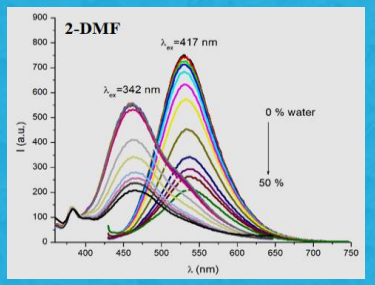


Electronic absorption (a) and emission spectra (b) of **1** in different solvents

Optical properties of naphthalimide derivatives in different solvents

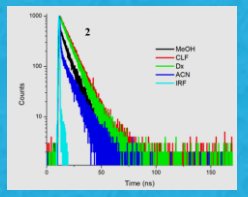
Solvent	1				2			
	ν_{max} (cm^{-1})	ν_{em} (cm^{-1})	$\Delta\nu$ (cm^{-1})	Φ	ν_{max} (cm^{-1})	ν_{em} (cm^{-1})	$\Delta\nu$ (cm^{-1})	Φ
Dioxane	24785	19650	5225	0.821	24875	19696	5179	0.875
Toluene	24570	20096	4474	0.546	24691	20145	4546	0.453
Chloroform	23980	19500	4480	0.686	23980	19516	4464	0.726
DCM	23696	19175	4521	0.451	23752	19219	4533	0.529
Methanol	23809	18917	4892	0.082	23866	18960	4906	0.081
Acetonitrile	24038	19175	4863	0.106	24154	18754	5400	0.017
DMF	23923	18942	4981	0.214	23923	18646	5277	0.064
DMSO	23809	18925	4884	0.015	23809	18835	4974	0.031

The electronic absorption and fluorescence spectra of naphthalimides are sensitive to the polarity of surrounding environment, and these derivatives can be excellent candidates for fluorescent sensors for water detection in solution because the emission is strongly depended on the solvent polarity and it is quenched even at low water levels. The quantum yields with absolute values from 0.01 to 0.87 were found to depend on the solvent nature.



Fluorescence spectra of **2** in **DMF** adding different water levels

In order to find out more information about the excited state dynamics of the naphthalimide derivatives, time resolved fluorescence experiments were made in solvents of different polarities.

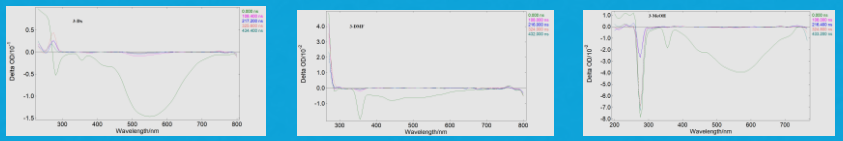


Fluorescence decay profiles of **2** in different solvents

Emission decay times for 1 and 2 in various solvents

Solvent	1		2	
	τ_1 (ns)/a_1(%)	τ_2(ns)/a_2(%)	τ_1(ns)/a_1(%)	τ_2(ns)/a_2(%)
Dioxane	8.09(100)		8.05(100)	
Toluene	7.96(100)		7.75(100)	
Chloroform	8.69(100)		8.49(100)	
DCM	8.36(100)		8.43(100)	
Methanol	7.68(93.51)	0.56(6.49)	0.26(14.04)	7.29(85.96)
Acetonitrile	0.81(10.43)	9.17(89.57)	0.44(40.32)	8.36(59.68)
DMF	0.55(7.93)	8.76(92.07)	0.21(41.46)	7.75(58.54)
DMSO	0.85(10.00)	8.80(90.00)	0.36(21.68)	8.23(78.32)

The transient absorption map in dioxane, dimethylformamide and methanol in the presence or absence of water revealed ground state bleaching bands (GSB) in the range 230 - 290 nm, whereas an absorption band in excited state (ESA) occurs at shorter wavelengths from 210 to 295 nm. At longer wavelength negative bands appeared which can be assigned to the stimulated emissions (SE).



Transient absorption map of **3** in different solvents

The obtained results suggest that these naphthalimide-based derivatives can act as a potential sensor detecting low amounts of water.