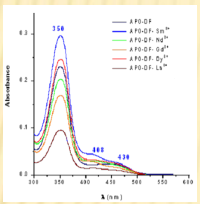
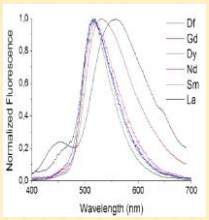
Applications and properties by using time-resolved fluorescence and transient absorption spectroscopy

Ionut Radu Tigoianu *, Serpa Carlos**, Prata Amilcar**, Pina Joao**, Mihaela Avadanei*, Dorel Ursu*, and Mirela Fernanda Zaltariov*
*"Petru Poni" Institute of Macromolecular Chemistry, 41A Gr. Ghica Voda Alley, 700487, Iasi, Romania
** University of Coimbra, Department of Chemistry, 3004-535 Coimbra, Portugal

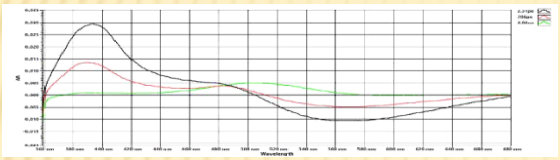
In this presentation, the absorption (transient absorption) and emission (steady state and time-resolved fluorescence) spectroscopy will be used to study, investigate and characterize the mechanisms of fluorescence quenching and obtaining new sensors for to detect toxic environments: heavy metals from water.



Absorption spectra

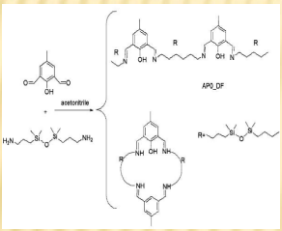


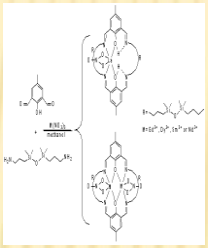
Fluorescence spectra



Transient absorption for AP0-DF-Gd

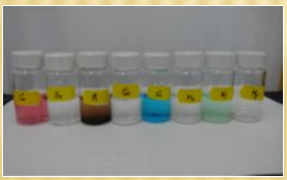
For this purpose, new compounds were synthesized for to have a good fluorescence (high quantum yield), stability and selective sensibility.



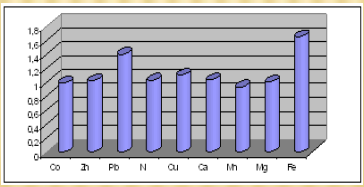


Macrocyclic ligand - obtained by the condensation reaction between siloxane diamine 1,3bis(aminopropyl)tetramethyldisiloxane (AP0) and 2,6-diformyl-4-methyl-phenol (DF) dialdehyde.
The lanthanide complexes were obtained by condensation between the siloxane diamine and dialdehyde followed by the addition of La, Gd, Dy, Nd, Sm in methanol at 1: 2 molar ratio as shown in scheme..

The study of fluorescence quenching by different metal ions such: Ni2+, Cu2+, Co2+, Zn2+, Fe3+, Mn2+, Ca2+, Pb2+, Cr3+, Cd2+, Sr2+, Mg2+ will be in solution, film at different temperature and variation in time for to demonstrate that these samples have a good stability and can be used as fluorescence sensors for the selective detection of metal ions

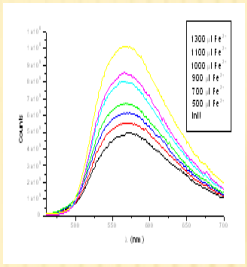


Metal ions in H2O

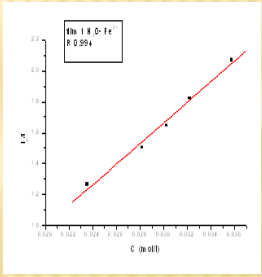


Quenchers- metal ions and the sensibility of these at the Film 1 APO DF/H2O

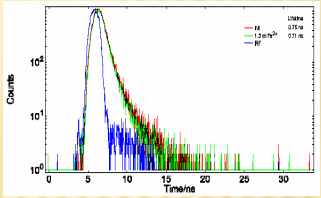
For fundamental study, theory of dynamic quenching, theory of static quenching and combined dynamic and static quenching were used, the lifetime in excited state, the quantum yield were estimated.



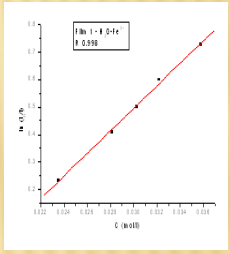
The fluorescence quenching of Film APO DF/H2O



The linear Stern-Volmer plot of Film APO DF/H2O



Film APO DF/H2O



The Perrin model of Film APO DF/H2O

Determination of quantum yield, and lifetime in solution and film

Samples	Q.Y(%)	t1 (ns)	A1 (%)	t2 (ns)	A2 (%)
Solution DMF					
AP0-DF-La3+	3.70	1.562	15.09	3.778	84.91
AP0-DF-Nd3+	1.87	0.385	29.53	3.646	70.47
AP0-DF-Sm3+	2.20	0.333	26.27	3.554	73.73
AP0-DF-Gd3+	2.90	0.307	41.11	3.633	58.89
AP0-DF-Dy3+	2.70	0.297	51.58	3.365	48.42
AP0-DF	1,60	0.2814	86.22	2.8133	13.78
Film					
AP0-DF-La3+	3.43	0.687	90.4	2.428	9.6
AP0-DF-Nd3+	1.36	0.773	85.14	3.835	14.86
AP0-DF-Sm3+	2.99	0.929	46.7	3.163	53.3
AP0-DF-Gd3+	2.88	0.914	51	3.482	49
AP0-DF-Dy3+	3.02	1.203	35.33	3.558	64.67
AP0-DF	19.94	0.6288			

The emission from singlet oxygen was observed at 1275 nm in all samples, and the lifetime and quantum yield are dependent on the substitution on metal ions. A new application of the compounds investigated for detection of toxic environments (heavy metals- Fe) was obtain, sensor for to detect Fe from water.