Study of the potential of Eu^{3+} pyridine-2,6-dicarboxylic acid based complexes for application in OLEDs.

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Abstract

The use of organolanthanide complexes as emitting centres in organic light emitting diodes (OLEDs) has been the focus of many studies over the last decade [1,2]. Many previous studies have focused on the use of β-diketonates as ligands from which energy transfer to the ion takes place, with an additional ligand to satisfy the coordination requirement of the lanthanide ions. In contrast to this approach we have carried research into the coordination of Eu^{3+} based on pyridine-2,6-dicarboxylic acid (DPA) ligands. In this case the coordination requirements of the Eu^{3+} ions are fully met by the 3 ligands thus reducing the deleterious quenching effects of neighbouring bonds including O-H.
We have further modified these DPA ligands with the aim of studying the effect of halogenation and other modifications on the energy transfer from ligand to Eu^{3+} ion and on the non-radiative relaxation of the excited Eu^{3+} ion.
Absorption, photoluminescence and photoluminescence-excitation spectra are reported for each of the modified complexes along with the $^5D_0$ to $^7F_2$ emission lifetime measured in a number of environments. We also present some preliminary Judd-Ofelt calculations on the complexes.
The results of this study confirm that these ligands form highly stable complexes that easily dissolve in a number of solvents. Strong characteristic emission is observed at 615 nm with lifetimes ranging from 1.2 ms to 2.9 ms depending on depending on the ligand and solvent. The potential of these and further modified complexes for use in OLEDs is also discussed.

[1] R.J. Curry and W.P. Gillin. Curr. Opin. Solid State Mater. Sci., **5**. 481-6 (2001).
[2] J. Kido and Y. Okamoto. Chem. Rev., **102**, 2357-68 (2002).