COLOUR TUNING PHOSPHOR OF $Eu_{0.01}Tb_{0.99}TMA{\cdot}4H_2O$ COMPLEX

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(1,3,5-benzenetricarboxylate)terbate(III) doped with 1 mol % trivalent europium ion ($Eu_{0.01}Tb_{0.99}TMA{\cdot}4H_2O$) was prepared using an aqueous reflux system. The $RECl_3$ aqueous solution was slowly added dropwise in the neutralised TMA solution at boiling point at 1:1 molar ratio followed by 2 h reflux [1]. The complex was characterized by elemental analysis (CHN), infrared spectroscopy (FTIR) and powder X-ray diffraction (XRD). The luminescence behaviour was investigated based on the excitation and emission spectra, as well as the phosphorescent decay study.
The CHN shows that the complex is a tetrahydrate, corroborating with the FTIR data, exhibiting a broad band in the spectral range from 3600 to 3200cm^{-1}. The bridge coordination mode between the TMA ligand and the RE^{3+} ions is confirmed by comparing the frequencies of symmetric and asymmetric stretching of the complex and the Na_3TMA salt. The emission spectrum of the compound, when excited at the maximum absorption band of the ligand (300 nm), shows a highly efficient energy transfer $TMA \rightarrow RE^{3+}$, evidenced by the absence of the emission band of the ligand. When excited in the RE^{3+} ions (345 and 394 nm for Tb^{3+} and Eu^{3+}, respectively), low intensity ligand phosphorescence is observed and the Eu^{3+} and Tb^{3+} ions transitions exhibit diferent intensity ratios. The phosphorescence decay curves shows uncommon long lifetime for the Eu^{3+} ion when excited in the ligand or Tb^{3+}, indicating multiple energy transfer pathways in the $Eu_{0.01}Tb_{0.99}TMA{\cdot}4H_2O$ complex.

Figure 1: Emission spectra at different excitations (left); phosphorescence decay curves (middle) and CIE diagram (right).

[1] E.R. Souza, I.G.N. Silva, E.E.S. Teotonio, M.C.F.C. Felinto, H.F. Brito, J. Lumin., 130, (2010) 283–291.