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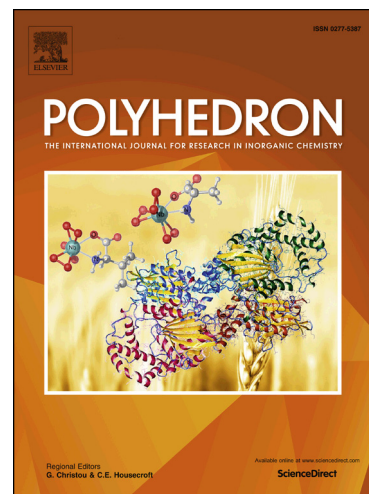
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Solvent dependence of the emission intensities in photoluminescent mononuclear europium(III) complexes with tetradentate Schiff base ligands

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Abstract

Mononuclear tetradentate Schiff base–europium(III) complexes with different counter cations, $X[\text{Eu}(3,5\text{-Cl salen})_2]$ $\{X = (\text{C}_2\text{H}_5)_3\text{NH}^+, (\text{C}_2\text{H}_5)_4\text{N}^+, \text{K}^+; \text{H}_2(3,5\text{-Cl salen})$: N,N' -bis-3,5-dichlorosalicylideneethanediamine $\}$, were prepared and photoluminescence properties of the europium(III) complexes in organic solvents (CH_3CN , DMSO , DMF , $(\text{CH}_3)_2\text{CO}$, CH_3OH , N -methylformamide (NMF), CH_2Cl_2) were investigated. All the emission spectra of the complexes displayed similar emission spectral patterns based on the $f-f$ transitions by excitation with 365 nm in the solvents. In contrast, the emission intensities of the complexes varied greatly in the different solvents. All the complexes $X[\text{Eu}(3,5\text{-Cl salen})_2]$ $\{X = (\text{C}_2\text{H}_5)_3\text{NH}^+, (\text{C}_2\text{H}_5)_4\text{N}^+, \text{K}^+\}$ displayed strong emission intensities in polar aprotic solvents ($\phi = 0.24\text{--}0.42$ in CH_3CN , DMF , DMSO , and $(\text{CH}_3)_2\text{CO}$), and weak emission intensities in polar protic solvents ($\phi = 0.052\text{--}0.10$ in CH_3OH and NMF) at 298 K. The emission intensities of $(\text{C}_2\text{H}_5)_3\text{NH}[\text{Eu}(3,5\text{-Cl salen})_2]$ and $(\text{C}_2\text{H}_5)_4\text{N}[\text{Eu}(3,5\text{-Cl salen})_2]$ in CH_2Cl_2 at 298 K are significantly different ($\phi = 0.016$ for $(\text{C}_2\text{H}_5)_3\text{NH}[\text{Eu}(3,5\text{-Cl salen})_2]$ and $\phi = 0.19$ for $(\text{C}_2\text{H}_5)_4\text{N}[\text{Eu}(3,5\text{-Cl salen})_2]$). Mononuclear yttrium(III) and gadolinium(III) complexes $X[\text{Y}(3,5\text{-Cl salen})_2]$ and $X[\text{Gd}(3,5\text{-Cl salen})_2]$ $\{X = (\text{C}_2\text{H}_5)_3\text{NH}^+, (\text{C}_2\text{H}_5)_4\text{N}^+\}$ were prepared. X-ray crystal structure analysis of $(\text{C}_2\text{H}_5)_3\text{NH}[\text{Gd}(3,5\text{-Cl salen})_2]$ was performed. Measurements of the ^1H and ^{13}C NMR spectra of the

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