

Structure, luminescence, and Raman spectroscopy of europium and terbium dipivaloylmethanates and other β -diketonates with 2,2'-bipyridine.

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Streszczenie

The study reveals the relationship between structural and spectroscopic characteristics of lanthanide dipivaloylmethanates with 2,2'-bipyridine derivatives $[\text{Ln}(\text{DPM})_3\text{L}]$ ($\text{Ln} = \text{Eu}, \text{Tb}$; $\text{L} = 2,2'$ -bipyridine, 4,4'-dimethyl-2,2'-bipyridine, 4,4'-diphenyl-2,2'-bipyridine) and fluorinated β -diketonates $[\text{Ln}(\beta)_3\text{Bpy}]$ ($\beta = \text{TFA}, \text{TFAA}, \text{BTFA}$) with the CN (Ln^{3+}) = 8 and the LnN_2O_6 coordination polyhedron in the form of a square antiprism. We discuss structural regularities resulting from the difference between Eu–O and Eu–N bond lengths in β -diketonates due to the changes in donor-acceptor properties of substituents and the steric factor. The effect of the main distortion $\Delta = r(\text{Eu–N}) - r(\text{Eu–O})$ of the Eu coordination polyhedron on the luminescence spectra and vibrational Raman spectra is considered. A qualitative correlation is demonstrated between the relative intensity of the ${}^5\text{D}_0\text{--}{}^7\text{F}_2$ (Eu^{3+}) electric dipole transition, which characterizes the degree of distortion of the nearest environment of the Eu^{3+} ion, and the lifetimes of excited electronic states ${}^5\text{D}_0$ (Eu^{3+}) and ${}^5\text{D}_4$ (Tb^{3+}). The contribution of nonradiative processes caused by high-frequency vibrations of ligands to the decay rate of ${}^5\text{D}_0$ (Eu^{3+}) and ${}^5\text{D}_4$ (Tb^{3+}) levels is discussed. The Raman spectra are analyzed in terms of studying the changes in vibrational frequencies of the Bpy molecule depending on the distortion Δ of the Eu coordination polyhedron.

Słowa kluczowe

Eu^{3+} , Tb^{3+} , dipivaloylmethanate, fluorinated, β -diketonates, molecule, 2'-bipyridine, crystal structure, luminescence, Raman spectra

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