

Effect of ligand radicals on vibrational IR, Raman and vibronic spectra of europium β -diketonates.

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Streszczenie

Vibrational IR, Raman spectra and vibronic sidebands of Eu^{3+} electronic transitions of europium tris- β -diketonates $\text{Eu}(\beta)_3\cdot\text{Ph}$ (β -dipivaloylmethane (DPM), acetylacetonate (AA), benzoylacetonate (BA), thenoyltrifluoroacetone (TTFA) and other β -diketonates; Ph-methyl-, phenyl-, and nitro-derivatives of 1,10-phenanthroline (Phen)) as well as $\text{Eu}(\beta)_3\cdot\text{Bpy}$ and $\text{Eu}(\beta)_3\cdot\text{D-Bpy}$ (Bpy- and D-Bpy-H- and D-2,2'-bipyridine) were studied. Effect of ligand radical properties on spectra and manifestation of the reciprocal influence of non-equivalent ligands in spectra are discussed. Dependence of the spectra on electronic density distribution in both ligands as well as on the strength of $\text{M}\text{--}\text{O}$ and $\text{M}\text{--}\text{N}$ bonds at the variation of radicals of one of the ligands, β or Ph, was examined. Shape of vibronic sidebands was analysed. Behaviour of bands in the middle and far regions of IR spectra of the series $\text{Eu}(\beta)_3\cdot\text{Phen}$ and $\text{Eu}(\text{TTFA})_3\cdot\text{Ph}$ was investigated. Increase of the polarising influence of Eu^{3+} ions on Phen and Bpy molecules and strengthening the $\text{Eu}\text{--}\text{N}$ bonds in TTFA compounds in comparison with DPM compounds were disclosed from the Raman spectra of $\text{Eu}(\beta)_3\cdot\text{Phen}$ and $\text{Eu}(\beta)_3\cdot\text{Bpy}$, that is in accordance with properties of β -diketonate radicals. Conclusion about weaker $\text{Eu}\text{--}\text{N}$ bonds in europium β -diketonates with heterocyclic diimines in comparison with corresponding nitrates was derived from the spectra. Spectral data concerning the relative strength of $\text{Eu}\text{--}\text{ligand}$ bonds are in agreement with available X-ray data.

Słowa kluczowe

Europium β -diketonates, β -Diketonate IR spectra, β -Diketonate Raman spectra, Eu^{3+} vibronic spectra

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