Relationships between structure and spectroscopic properties of Nd^{3+} ethylenediaminetetramethylene-phosphonates and ethylenediaminetetraacetates.

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The structural and spectroscopic properties of the Nd^{3+} compounds $[C(NH_2)_3]_7[Nd(EDTMP)(CO_3)]\cdot 10H_2O$, $K_{17}H_3[Nd_4(EDTMP)_4]\cdot 36H_2O$, $[C(NH_2)_3][Nd(EDTA)(H_2O)_3]$ and $Na[Nd(EDTA)(H_2O)_3]\cdot 5H_2O$ are presented (H_4EDTA = ethylenediaminetetraacetic acid, H_8EDTMP is a phosphonic acid analogue of H_4EDTA). The obtained monomeric $[Nd(EDTMP)(CO_3)]^{7-}$ and tetrameric $[Nd_4(EDTMP)_4]^{20-}$ structures, in which bidentate carbonate and tridentate bridged phosphonate coordination patterns appear, are exceptional. The use of different countercations has allowed us to assess their role in crystal formation and their influence on the spectroscopic properties of the investigated crystals. The countercations slightly change the geometry of $[Nd(EDTA)(H_2O)_3]^-$ and some subtle modifications of the geometry of the carboxylic groups is observed. These changes are discussed in the context of hypersensitive transition intensities. The intensities of the f–f transitions in all studied crystals were determined and analyzed basing on the Judd–Ofelt theory. Luminescence of the Nd^{3+} ions in the NIR region could be observed solely in the phosphonate complexes. The luminescence quantum yields were calculated from the luminescence lifetimes and the Judd–Ofelt parameters. The Φ value for the rigid tetramer $[Nd_4(EDTMP)_4]^{20-}$ is twice as large (7 %) as that for the monomer $[Nd(EDTMP)(CO_3)]^{7-}$ (3.5 %).

Słowa kluczowe

lanthanides, structure elucidation, luminescence, phosphonates

Adres publiczny

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