

Optical spectra and excited state relaxation dynamics of Sm^{2+} ions in SrCl_2 , SrBr_2 and SrI_2 crystals.

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Streszczenie

Samarium(2+) doped single crystals of SrCl_2 , SrBr_2 and SrI_2 with a nominal samarium concentration of 0.12, 0.16 and 0.13 at%, respectively, were grown by the Bridgman method. XRD examination revealed that obtained samples are single phase and their structures are consistent with those intentional. Based on preliminary spectroscopic measurement it was ascertained that Sm^{2+} ions are incorporated without traces of Sm^{3+} contamination. High resolution absorption, luminescence and excitation spectra as well as luminescence decay curves were measured as a function of temperature in the 4.2–300 K region. It was found that structural peculiarities of the host crystals affect strongly spectroscopic features of incorporated Sm^{2+} ions. At room temperature all systems under study show a broad-band luminescence related to the parity allowed inter-configurational $4f^55d^1 - 4f^6$ transitions of Sm^{2+} . At 5 K a broad band luminescence vanishes in $\text{SrCl}_2:\text{Sm}^{2+}$ and a resulting luminescence spectrum shows a rich fine structure consisting of narrow lines that we attribute to magnetic dipole transitions within the $4f^6$ configuration of Sm^{2+} ions located in centrosymmetric sites and/or their vibrational side bands. Based on an analysis of luminescence decay curves we attribute numerous narrow lines that appear in luminescence spectra of $\text{SrBr}_2:\text{Sm}^{2+}$ recorded below 25 K to the $^5D_0 - ^7F_J$ ($J = 0-4$) intra-configurational transitions of Sm^{2+} ions located in sites with C_4 and C_1 symmetry. A long-lived luminescence related to intra-configurational transitions was not observed in $\text{SrI}_2:\text{Sm}^{2+}$ even at 4.2 K.

Słowa kluczowe

lanthanide ions, Optical spectroscopy, Divalent samarium, Excited states, Strontium halides

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