

Optical spectra and crystal field calculation for $\text{SrB}_4\text{O}_7\text{:Sm}^{2+}$.Autorzy

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Streszczenie

Undoped and samarium-doped SrB_4O_7 polycrystalline samples were prepared by a solid state reaction method in air. XRD examination revealed that the undoped sample is consistent with the pure SrB_4O_7 phase but in samarium-doped sample in addition to the main tetraborate SrB_4O_7 phase there is a little amount of metaborate. Based on preliminary spectroscopic examination it was ascertained that Sm^{2+} ions are incorporated without measurable traces of Sm^{3+} admixture. High resolution luminescence spectra and decay curves of Sm^{2+} luminescence were measured as a function of temperature in the 5-550K temperature region. Energies of crystal field components of the $^7\text{F}_J$ ($J=1-5$) multiplets at 5K and those of the $^5\text{D}_1$ multiplet at 300K were determined from luminescence spectra and used subsequently as input data for the crystal field calculation. Performed crystal field calculation predicts the energy level scheme for the 4f^6 configuration of Sm^{2+} in SrB_4O_7 up to 29000cm^{-1} and makes it possible to assess the contribution of transitions from the excited states above the $^5\text{D}_1$ to luminescence phenomena. Evaluated activation energy $E_a \sim 4600\text{cm}^{-1}$ characterizing a steep decrease of the $^5\text{D}_0$ lifetime of Sm^{2+} between 320K and 550K indicates strongly that electronic origin of the lowest energy $^7\text{F}_0 - 4\text{f}^5\text{d}^1$ vibronic transitions is located around 19200cm^{-1} , slightly below the $^7\text{F}_0 - ^5\text{D}_3$ transition energy.

Słowa kluczowe

Divalent samarium, luminescence, Tetraborate, Crystal field, Red phosphor

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