Trends in Hamiltonian parameters determined by systematic analysis of f-d absorption spectra of divalent lanthanides in alkali-halides hosts: III. $CsSrBr_3:Ln^{2+}$ (Ln = Nd, Sm, Eu, Tm, and Yb)

Autorzy

Mirosław Karbowiak

Kamila Maciejewska

Czesław Rudowicz

Rok wydania

2019

Czasopismo

Journal of Luminescence

Numer woluminu

215

Strony

116622/1-116622/12

DOI

10.1016/j.jlumin.2019.116622

Kolekcja

Naukowa

Język

Angielski

Typ publikacji

Artykuł

Streszczenie

Systematic analysis of energy level structure of the $4f^N-{}^15d^1$ configuration of divalent lanthanide Ln^{2+} ions across Ln series is advantageous. It enables determination of more reliable Hamiltonian parameters and uncovering trends in parameter values. Sufficiently systematic trends inherent in parameters allow predicting the spectrum for other Ln ions based on the parameter sets derived for another ion in the same matrix. Due to lack of spectral data such analysis has been carried out for Ln^{2+} ions in but a few cases. In previous two papers systematic analysis of the f-d absorption spectra of Ln^{2+} in alkali-halides hosts: $SrCl_2:Ln^{2+}$(Ln=Nd, Sm, Eu, Tm, and Yb) and $CaCl_2:Ln^{2+}$ (Ln=Sm, Eu, Tm, and Yb) was reported. Results of such analysis for $CsSrBr_3:Ln^{2+}$ (Ln=Nd, Sm, Eu, Tm, and Yb) based on novel 4.2K absorption spectra for these systems are presented herewith. Due to successful stabilization of Nd^{2+} in $CsSrBr_3$ host, one of only few Nd^{2+} spectra and only the second one in a bromide host was obtained. Using a uniform methodology based on a parametric Hamiltonian model proposed earlier, a systematic analysis of the spectra is performed. This approach yields refined and consistent sets of the free-ion parameters and crystal-field ones. The trends in Hamiltonian parameters across Ln series revealed for bromide host are well-compatible with those for chloride hosts. The hypothesis that trends in parameters should not depend on the chemical character of the host is verified. The results confirm the predictive capability of the proposed methodology, which enables modeling the f-d absorption spectra of any Ln^{2+} ion utilizing knowledge of spectra for other Ln^{2+} ions in similar hosts.