

## Trends in Hamiltonian parameters determined by systematic analysis of f-d absorption spectra of divalent lanthanides in alkali-halides hosts: III. CsSrBr<sub>3</sub>:Ln<sup>2+</sup> (Ln = Nd, Sm, Eu, Tm, and Yb)

### Autorzy

Miroslaw Karbowskiak

Kamila Maciejewska

Czesław Rudowicz

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### 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.

Słowa kluczowe

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Optical absorption spectroscopy, Crystal and ligand fields, CsSrBr<sub>3</sub>:Ln<sup>2+</sup>, Divalent lanthanide, Divalent Nd Sm Eu Tm and Yb

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