

The high-resolution 4f—5d absorption spectrum of divalent dysprosium (Dy²⁺) in strontium chloride host SrCl₂: fine structure and zero-phonon transitions revealed.

Autorzy

Miroslaw Karbowskiak

Czesław Rudowicz

Jakub Cichos

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Streszczenie

The virtual lack of information on electronic spectra of divalent lanthanide elements (Ln²⁺) other than Sm²⁺, Eu²⁺, Tm²⁺, and Yb²⁺ has prompted us to set for synthesis and characterization of novel Ln²⁺ systems. First successful attempt concerned SrCl₂/Nd²⁺ single crystals. Here, we report stabilization of divalent dysprosium in a chloride host. Importantly this has been accomplished with Dy ions introduced in a divalent state during synthesis, unlike by γ -irradiation of Dy³⁺ systems employed previously. This synthesis method yields good quality SrCl₂/Dy²⁺ single crystals. The electronic absorption spectra of Dy²⁺ doped in SrCl₂ have been recorded with high resolution at liquid helium temperature (4.2 K). Identification of the absorption bands occurring in the spectral range of 5000-45000 cm⁻¹ is achieved. On the basis of theoretical calculations using semiempirical Hamiltonian model, assignment of bands and determination of the Hamiltonian parameters for Dy²⁺(4f⁹5d¹) configuration is carried out. The experimental and theoretical studies reveal fine structure and zero-phonon transitions and thus enable high-resolution assignment of spectral lines. It is shown that spin-forbidden transitions gain relatively high intensity due to significant admixing of low-spin character to nominally high-spin states.

Adres publiczny

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<https://www.acs.org/content/acs/en.html>