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Optical studies of the uniaxial stress-induced orbital alignment of the Cr^{2+} centers in KZnF3 single crystal

Nikitin S., Gracheva I., Zverev D., Yusupov R.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2016 Author(s).Observation of an intense optical linear dichroism arising in cubic KZnF3:Cr crystal at low temperatures under uniaxial stress applied along the four-fold axis is reported. Dichroism occurs in the range of the wide vibronic absorption band corresponding to 5Eg → 5T2g transition of the Cr2+ ions. Strain dependences of the dichroism value were studied at the temperatures of 2.0 K, 4.2 K, and 77 K. We associate our observations with the Jahn-Teller effect in the 5Eg ground state of the Cr2+ ion. The model is proposed based on a redistribution of the centers between the minima of the EO×e problem adiabatic potential that become inequivalent under uniaxial stress applied along the four-fold axis of the crystal. It is shown that random strains in the sample have to be taken into account to achieve the quantitative agreement of the model predictions with experimental data. It is found that random strains in the studied sample originate predominantly from point defects. Obtained parameter values are inversion splitting δ = 9.2 ± 1.6 cm-1, electron-strain coupling constant qVES = 16 500 ± 600 cm-1, width of the random strain distribution w = (6.9 ± 0.5) · 10-5. It is shown also that the minima of the [CrF6]4- cluster adiabatic potential correspond to the elongated along the four-fold axes configurations.

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