The g Factors and Defect Structure of Orthorhombic Dy^{3+} Ions in CdF_2 Crystals

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The electronic paramagnetic resonance g factors g_x, g_y and g_z of an orthorhombic Dy^{3+} center in CdF_2 are studied by the perturbation formulae of the g factors for a $4f^9$ ion in orthorhombic symmetry. In these formulae, the contributions to g factors due to J-mixing among the ground $^6H_{15/2}$, the first excited $^6H_{13/2}$ and the second excited $^6H_{11/2}$ states via crystal-field interaction, lead to admixtures among the states with the same J-value via spin-orbit coupling. In addition, the admixtures between the lowest Kramers doublet $\Gamma\gamma$ and other 20 Kramers doublets Γx within the states ^6H_J ($J = 15/2$, 13/2 and 11/2) via crystal-field and orbital angular momentum interactions are considered. In the above orthorhombic center, the impurity Dy^{3+} is associated with co-doped crystals with alkali metal ions in the [110] axis. By analyzing the g factors, we find that the impurity Dy^{3+} ion does not reside in the ideal Cd^{2+} site but moves towards the co-doped alkali metal ion along the [110] direction by a displacement $\Delta Z \approx 0.272$ Å.

Key words: Crystal-Field Theory; Electron Paramagnetic Resonance; Superposition Model; Dy^{3+}; CdF_2.