

Electron paramagnetic resonance of Gd³⁺ aqua complexes in vitrified aqueous solutions and Gd³⁺ aqua ions adsorbed on the capillary surface

Vishnevskaya G., Frolova E., Gataullin A.

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

Abstract

Electron paramagnetic resonance (EPR) spectra of Gd³⁺ aqua complexes are measured in dilute aqueous solutions of Gd(NO₃)₃ ($C < 0.2$ M) at room temperature. A partial resolution of the fine structure observed in the spectra is characteristic of solid disordered systems and results in an increase in the effective width of the EPR line with a decrease in the Gd³⁺ concentration. This phenomenon is explained in terms of adsorption of Gd³⁺ aqua ions on the surface of the measuring capillaries. The fine structure is revealed in the EPR spectra of Gd(NO₃)₃ aqueous solutions, namely, the Gd(NO₃)₃ solutions vitrified at a temperature of 77 K (with an addition of 10-15 vol % glycerol) and Gd(NO₃)₃ solutions quasi-vitrified at 298 K (with an addition of 70-90 vol % glycerol). Analysis of the EPR spectra demonstrates that these solutions contain two types of aqua complexes with fine structure parameters $D_1 = 180$ G and $D_2 = 580$ G. Reasoning from a comparison with x-ray diffraction data, the fine structure parameters D_1 and D_2 are assigned to higher symmetric eight-coordinate and lower symmetric nine-coordinate Gd³⁺ aqua complexes, respectively. © 2003 MAIK "Nauka/Interperiodica".

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