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Identification of the La₆F₃₇ cubooctahedral clusters in mixed crystals (BaF₂)_{1-x}(LaF₃)_x by the electron paramagnetic resonance method

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Abstract

The electron paramagnetic resonance (EPR) spectra of mixed crystals (BaF₂)_{1-x}(LaF₃)_x ($x = 0, 0.001, 0.002, 0.005, 0.010, 0.020$) doped with Ce³⁺ ions (0.1%) are investigated at a frequency $\nu \approx 9.5$ GHz in magnetic fields up to 1.45 T at temperatures $T = 10$ and 15 K. The EPR spectrum of "pure" barium fluoride BaF₂ ($x = 0$) is characterized by a single Ce³⁺-F⁻ center with tetragonal symmetry (i.e., the O center with $g_{||} = 2.601$ and $g_{\perp} = 1.555$). For a lanthanum trifluoride concentration $x > 0$, the spectrum exhibits new lines due to the presence of the clusters containing Ce³⁺ and La³⁺ ions. The intensity of EPR signals from the O centers decreases rapidly as the lanthanum trifluoride concentration x increases. The lines attributed to a paramagnetic center with tetragonal symmetry and strongly anisotropic g factors (i.e., the K center with $g_{||} = 0.725$ and $g_{\perp} = 2.52$) are separated in the complex EPR spectrum with the use of the angular dependence of the EPR signal intensity measured for the samples with $x > 0.002$. This center is identified as a cubooctahedral cluster of the La₆F₃₇ type in which one of the La³⁺ ions is replaced by the Ce³⁺ ion. © 2007 Pleiades Publishing, Ltd.

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