The effect of charge compensation by means of Na^+ ions on the luminescence behavior of Sm^{3+} - doped $CaAl_4O_7$ phosphor.

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Results of structural and spectroscopic measurements of Sm^{3+} doped calcium aluminates: $Ca_{1-x}Sm_xAl_4O_7$ and $Ca_{1-2x}Sm_xNa_xAl_4O_7$ (x=0.0005, 0.002, 0.01, 0.02, 0.03, 0.05) obtained by the modified Pechini method are presented. All samples yield intense orange–red emission under violet excitation (404.5nm). Narrow bands corresponding to characteristic f–f intraconfigurational transition of Sm^{3+} in excitation and emission spectra were observed. The influences of the concentration of Sm^{3+} as well as charge compensation by co-doping with Na^+ ions on the luminescent properties of the phosphor were investigated. Detailed analysis of the emission spectra of Sm^{3+} doped and Sm^{3+} ,Na^+ co-doped $CaAl_4O_7$ powders proved that activator ions substitute Ca^{2+} in the host. Co-doping with Na^+ ions enhanced greatly the intensity of the luminescence. Concentration dependencies of the intensity of luminescence and its decay kinetics proved the emission quenching at higher dopant contents due to cross-relaxation processes between Sm^{3+} ions. Fitting of the $^4G_{5/2}$ state fluorescence decay to the Inokuti–Hirayama model indicated dipole–dipole interaction as the dominant mechanism of the cross-relaxation processes.

Słowa kluczowe

CaAl4O7, Sm3+-doped, luminescence, decay kinetics

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