Ce^{3+}-sensitized red Mn^{2+} luminescence in calcium aluminoborate phosphor material.

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Streszczenie

Ce^{3+} doped and Ce^{3+},Mn^{2+} co-doped calcium aluminoborate (CAB) phosphors were synthesised by solid-state reaction method and their optical properties were studied. X-ray powder diffraction, SEM and TEM studies indicated the crystallization of the main trigonal $CaAl_2B_2O_7$ phase and the presence of an additional non-crystalline phase. It was also observed that increasing dopant concentration promotes phase separation. Hence, both series of phosphors demonstrated the changes in luminescence properties via activator concentration variation. Upon UV excitation (λ_{ex} = 310 nm) Ce^{3+} doped and Ce^{3+},Mn^{2+} co-doped materials yielded intensive blue and pinkish luminescence, respectively. The spectra of CAB:Ce^{3+} samples showed a broad emission band due to 5d→4f transition of Ce^{3+}, which broadened and shifted to longer wavelengths with increasing dopant content. Mn^{2+}co-doping caused appearance of another broad-band emission with a maximum of 680 nm, resulting from the $^4T_1(^4G) \rightarrow {}^6A_1(^6S)$ transition of Mn^{2+}. Detailed analysis of the emission and excitation spectra as well as decay time traces as a function of dopant concentration showed that efficient resonant energy transfer mainly occurs between Ce^{3+} and Mn^{2+}incorporated in the non-crystalline phase in CAB material. The estimated values of energy transfer efficiency of CAB:Ce^{3+}(3%),Mn^{2+}(4%) is close to 52%.

Słowa kluczowe

Calcium aluminoborate, energy transfer, Ce3+ luminescence, Mn2+ luminescence, phase separation

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