The effect of charge compensation through alkali metal co-doping on the luminescence behaviour of $SrAl_4O_7{:}Sm^{3+}$ phosphor.

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Streszczenie

A comparative study of the luminescent properties of singly Sm3+-doped and Sm3+,Na+co-doped strontiumaluminates: Sr1−xSmxAl4O7and Sr1–2xSmxNaxAl4O7(x = 0.001–0.1), as a function of activator concentration atroom and low (77 K, 16 K) temperature is reported. Upon an excitation at 402 nm all samples exhibit intensiveorange-red emission due to the characteristic 4f-4f Sm3+transitions with maximum located at around 598.7 nm.It was found that luminescence properties of both series of materials differ significantly. In SrAl4O7:Sm3+at leastfour distinct activator symmetry sites were identified, which is due to presence of charge compensating defects inthe crystal lattice and tendency to form Sm pairs. Charge compensation through alkali metal co-doping led to asmaller perturbation of the local environment symmetry of Sm3+ions and significantly enhanced luminescenceintensity. In SrAl4O7:Sm3+,Na+only two of the four non-equivalent centers of Sm3+were found. One of themcorresponds to isolated Sm3+ion occupying basically undistorted Sr2+symmetry site offered by host lattice butthe other is associated with Sm3+ions forming pairs. Analysis of the luminescence decay traces of both types ofmaterials showed a decreasing decay time constant with rising activator concentration what was mainly attributed to cross-relaxation processes between Sm3+ions. This effect was slightly more pronounced for theSm3+,Na+co-doped series due to higher population of Sm3+pairs. Fitting of the4G5/2statefluorescence decayto the Inokuti–Hirayama model indicated different dominant mechanisms of the self-quenching luminescence ofSm3+in SrAl4O7:Sm3+and SrAl4O7:Sm3+,Na+, respectively, dipole-quadrupole interaction and dipole–dipoleinteractio

Słowa kluczowe

Sm3+doped, luminescence, decay kinetics, charge compensation, SrAl4O7

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