# LUMINESCENCE OF $Na_{3.6}Y_{1.8-x}Sc_x(PO_4)_3$ SOLID SOLUTIONS

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Phosphors are widely used in lighting, displays, sensors and other devices. It is well known that thermal stability of phosphors, strongly dependent on the phosphor host, is one of the main requirements in many applications. The undesirable thermal quenching may cause the significant reduction of phosphor efficiency and degradation of colour stability in devices. Recently, a significant enhancement of luminescence efficiency and thermal stability was demonstrated for the $NaZr_2(PO_4)_3:Eu^{2+}$ phosphor upon the $Na^+$-$Sc^{3+}$ substitution [1]. Also, it has been reported that among isostructural Na-based phosphates containing Y, Lu or Sc cations only the $Na_3Sc_2(PO_4)_3$ compound demonstrates intrinsic emission [2]. Here, we present the results of the luminescence study of the intrinsic emission of $Na_{3.6}Y_{1.8-x}Sc_x(PO_4)_3$ solid solutions in wide energy and temperature region.

A set of single-phase $Na_{3.6}Y_{1.8-x}Sc_x(PO_4)_3$ (x = 0-0.7) solid solutions was obtained for the first time using a high-temperature solid-state method. X-ray diffraction study revealed that all compounds were synthesized with a NASICON-type structure. Luminescence spectra of studied solutions under the VUV excitation as well as under high energy excitation with an electron beam are characterized by a single emission band in the UV range, which shifts to the short wavelength region with yttrium substitution by scandium. The emission intensity of this band increases up to 3 times depending on the Sc concentration, reaching maximum at x = 0.3. The analysis of luminescence excitation spectra showed its excitonic origin. At excitation below the fundamental absorption edge an additional band at 450 nm associated with structural defects is observed in the luminescence spectra. A strong decrease of the intensity of exciton emission with temperature, associated with the process of thermal quenching, was observed for all the solid solutions studied. It is concluded that the low temperature stability of luminescence for the $Na_{3.6}Y_{1.8-x}Sc_x(PO_4)_3$ series is related to the band structure features, namely the participation of Na and P electronic states in the formation of the conduction band bottom, which promote the migration of electronic excitations.

References

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