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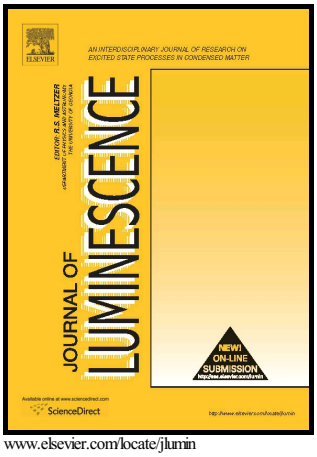

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Zinc phosphate glasses activated with $Dy^{3+}/Eu^{3+}/Sm^{3+}$ and $Tb^{3+}/Eu^{3+}/Sm^{3+}$ for reddish-orange and yellowish white phosphor applications

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ABSTRACT

Spectroscopic evaluations of $Dy^{3+}/Eu^{3+}/Sm^{3+}$ and $Tb^{3+}/Eu^{3+}/Sm^{3+}$ doped zinc phosphate glasses, based on excitation and emission spectra, and emission decay measurements, are particularly focused on potential white light-emitting diodes applications. All the excitation wavelengths located in the 337-382 nm range, match with the emissions of AlGaN, GaN and InGaN LEDs. The $Dy^{3+}/Eu^{3+}/Sm^{3+}$ doped zinc phosphate glass excited at 347 nm displays yellowish white tonality according with the $x = 0.396$ and $y = 0.408$ CIE1931 chromaticity coordinates and correlated color temperature (*CCT*) value of 3837 K, whereas under 362, 374 and 382 nm excitations, it displays reddish-orange tonality with CIE1931 chromaticity coordinates (and *CCT* values): $x = 0.503$ and $y = 0.398$ (2075 K), $x = 0.570$ and $y = 0.388$ (1640 K), and $x = 0.527$ and $y = 0.386$ (1804 K), respectively, with color purities higher than 72%. The Dy^{3+} and Sm^{3+} emission decay analysis suggests that non-radiative energy transfer processes from Dy^{3+} to Eu^{3+} and/or Sm^{3+} and Sm^{3+} to Eu^{3+} take place with efficiencies of 0.09 ± 0.04 and 0.15 ± 0.04, respectively. The Dy^{3+} and Sm^{3+} emission decay fitting by the Inokuti-Hirayama model, indicates that electric dipole-quadrupole and quadrupole-quadrupole interactions might respectively mediate the energy transfer processes inside the Dy^{3+}-Sm^{3+}-Eu^{3+} clusters. The $Tb^{3+}/Eu^{3+}/Sm^{3+}$ doped zinc phosphate glasses only exhibits reddish-orange emission tonality with CIE1931 chromaticity coordinates and (*CCT* values): $x = 0.510$ and $y = 0.425$ (2210 K), $x = 0.549$