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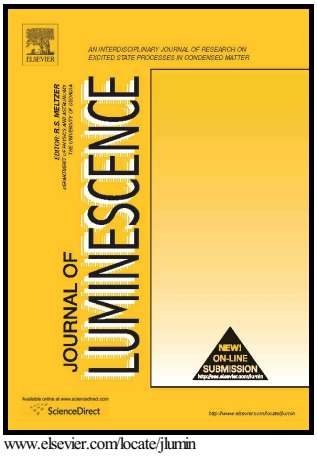

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Emission spectra and energy transfer studies in Dy^{3+} and Dy^{3+}/Eu^{3+} co-doped potassium fluorophosphate glasses for white light applications

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Abstract

Potassium fluorophosphate (KFP) glasses doped with different concentrations of Dy^{3+} ions and co-doped with Eu^{3+} ions were prepared to study the luminescence spectra. Optical transition properties of Dy^{3+} doped KFP glasses were assessed with the aid of Judd–Ofelt (J-O) theory. Visible luminescence spectra have been obtained for Dy^{3+} ions and Eu^{3+} ions under 350 nm excitation. Yellow emission of Dy^{3+} was exhibited mainly due to the transition $^4F_{9/2}\rightarrow{}^6H_{13/2}$ centered at 573 nm. Energy transfer between Dy^{3+} and Eu^{3+} ions and decay curves of Dy^{3+} and Dy^{3+}/Eu^{3+} co-doped KFP glasses have been studied using fluorescence spectra. The decay of $^4F_{9/2}$ excited level is found to be single exponential for lower concentrations up to 0.3mol% and becomes non-exponential for (greater than 0.3 mol%) higher concentrations. It is noticed that with the increase of Dy^{3+} concentration, the lifetime values of $^4F_{9/2}$ level was decreased. Intense Reddish orange light was observed in addition to blue and yellow luminescence in these glasses. CIE chromacity coordinates were calculated to study the generation of white light from the luminescent transitions. The results of this experiment show significant promise for use in white light applications. The effective properties of Dy^{3+}/Eu^{3+} co-doped KFP glasses indicated that the present glasses might be useful for optical materials.

GRAPHICAL ABSTRACT

Dy^{3+} doped potassium fluorophosphate (KFP: $50P_2O_5{-}20KH_2PO_4{-}10ZnO\text{-}10AlF_3\text{-}10KF$ (in mol%)) glass matrices and also Dy^{3+} co-doped with Eu^{3+} above glass matrices have been prepared. These glass matrices were characterized by their optical properties and visible luminescence spectra were recorded for the transitions $^4F_{9/2}\rightarrow{}^6H_{15/2}$ and $^4F_{9/2}\rightarrow{}^6H_{13/2}$ of Dy^{3+} ion and $^5D_0\rightarrow{}^7F_J$ (J=1,2,3 and 4) transitions of Eu^{3+} ions. The CIE - colour coordinates of Dy^{3+} doped and Dy^{3+}/Eu^{3+} co-doped glasses have been analyzed. These observations reveals that the co-doped glass (0.3 Dy^{3+}/3.0Eu^{3+}) may be useful for white light applications.