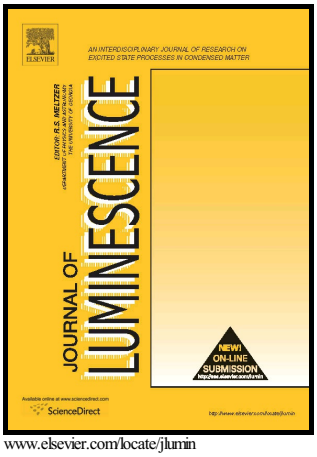

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Abstract

Recently, transition metal Mn^{2+} ions emerged as a potent competitor of generally used rare-earth elements due to its abundant reserve and cheaper cost. In this work, the transition metal Mn^{2+} doped Ca-α-sialon phosphor with compositions of $Ca_{1-x}Si_9Al_3ON_{15}:xMn^{2+}$ was designed and successfully prepared by high-temperature solid-state method. The produced Mn^{2+} doped Ca-α-sialon phosphor exhibits a dominant orange-red emission centered at ~600 nm upon UV light excitation of 265 nm, which is ascribed to the characteristic $^4T_1(^4G)–^6A_1(^6S)$ transition of Mn^{2+}. The band gap energy (5.61 eV) of the phosphors was calculated based on UV-vis diffuse reflectance spectra. Spectroscopy of temperature-dependent emission demostrates that the luminescence of the optimized Ca-α-sialon:$0.12Mn^{2+}$ composition exhibits a good color stability against heat and excellent resistance to thermal impact, due to its high activation energy of 0.284 eV. Further, the Electron Paramagnetic Resonance (EPR) spectra were recorded to elucidate the structural characteristic of Mn^{2+} and possible vacancy defects in phosphors. The internal quantum efficiency of the prepared product reaches up to ~48.2%. All the results inform that this kind of phosphors may