

Luminescent properties and quenching effects of Pr³⁺ co-doping in SiO₂:Tb³⁺/Eu³⁺ nanophosphors

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Abstract

Luminescence properties of Pr³⁺ single doped SiO₂ and Pr³⁺ co-doped SiO₂:Tb³⁺/Eu³⁺ nanophosphors synthesized using sol-gel method were investigated. X-ray diffraction (XRD), and scanning electron microscope (SEM) were used to study the phase structure and particle morphology, respectively. The photoluminescence (PL) and cathodoluminescence (CL) properties of SiO₂:Pr³⁺ and Pr³⁺ co-doped SiO₂:Tb³⁺/Eu³⁺ were investigated. The concentration quenching effects at high concentrations of Pr³⁺ were observed from both PL and CL data. The PL and CL intensities from SiO₂:Eu³⁺/Tb³⁺ nanophosphors were shown to decrease significantly with Pr³⁺ co-doping and the possible causes for the decrease are discussed. Fluorescence lifetimes of the 1D₂ emitting level of Pr³⁺ were determined from luminescence decay curves of SiO₂:Pr³⁺ at different Pr³⁺ concentrations.