Influence of Nd^{3+} and Er^{3+} concentration on NIR luminescence properties in calcium borophosphate (CBP) phosphors

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Abstract

Different concentrations of neodymium (Nd^{3+}) and erbium (Er^{3+}) doped calcium borophosphate (CBP) phosphors were prepared by solid state reaction method. These phosphors were characterized by XPS, photoluminescence (PL) and decay profiles. XPS spectra were recorded and discussed about various anionic groups. NIR photoluminescence spectra were measured and studied for Nd^{3+} and Er^{3+} doped CBP phosphors of different concentrations. The PL measurements showed that the intensity of luminescence increased with increasing doping concentrations upto 0.6 mol % and then decreased at higher concentrations due to the concentration quenching effect for both the ions. Decay curves were obtained for the energy levels, $^4F_{3/2}$ of Nd^{3+} and $^4I_{13/2}$ of Er^{3+} in these CBP phosphors and lifetimes were measured. In the case of Er^{3+} ion, visible emission and decay profiles were also measured in these phosphors. CIE color chromaticity diagrams are drawn for Er^{3+} ions in calcium borophosphate phosphors. The above results showed that Nd^{3+} and Er^{3+} doped CBP phosphors might be useful for NIR and green emission applications.

Key words: Solid state reaction; XPS spectra; ^{31}P solid state NMR;; photoluminescence; Decay lifetimes; CIE co-ordinates.

1. Introduction

Near-infrared (NIR) light emitting photonic devices are used in several broad areas such as bio-imaging [1], fiber optic communications [2], solid state lasers [3], chemical and biological sensing [4]. Phosphates of suitable phosphor composition doped with rare earth ions have shown