

## Spectroscopic properties of $\text{Eu}^{3+}/\text{Nd}^{3+}$ co-doped phosphate glasses and opaque glass-ceramics (Article)

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### Abstract

This paper reports the fabrication and characterization of  $\text{Eu}^{3+}/\text{Nd}^{3+}$  co-doped phosphate (PNE) glasses and glass-ceramics as a function of  $\text{Eu}^{3+}$  concentration. The precursor glasses were prepared by the conventional melt quenching technique and the opaque glass-ceramics were obtained by heating the precursor glasses at 450 °C for 30 h. The structural and optical properties of the glass and glass-ceramics were analyzed by means of X-ray diffraction, Raman spectroscopy, UV-VIS-IR absorption spectroscopy, photoluminescence spectra and lifetimes. The amorphous and crystalline structures of the precursor glass and opaque glass-ceramic were confirmed by X-ray diffraction respectively. The Raman spectra showed that the maximum phonon energy decreased from 1317  $\text{cm}^{-1}$  to 1277  $\text{cm}^{-1}$  with the thermal treatment. The luminescence spectra of the glass and glass-ceramic samples were studied under 396 nm and 806 nm excitation. The emission intensity of the bands observed in opaque glass-ceramic is stronger than that of the precursor glass. The luminescence spectra show strong dependence on the  $\text{Eu}^{3+}$  ion concentration in the  $\text{Nd}^{3+}$  ion photoluminescence (PL) intensity, which suggest the presence of energy transfer (ET) and cross-relaxation (CR) processes. The lifetimes of the  $^4\text{F}_3/2$  state of  $\text{Nd}^{3+}$  ion in  $\text{Eu}^{3+}/\text{Nd}^{3+}$  co-doped phosphate glasses and glass-ceramics under 806 nm excitation were measured. It was observed that the lifetimes of the  $^4\text{F}_3/2$  level of  $\text{Nd}^{3+}$  of both glasses and glass-ceramics decrease with the increasing  $\text{Eu}^{3+}$  concentration. However in the case of opaque glass-ceramics the lifetimes decrease only 16%. © 2015 Elsevier B.V. All rights reserved.

### Author keywords

$\text{Eu}^{3+}/\text{Nd}^{3+}$  co-doped glasses; Glass-ceramics; Opaque glass-ceramics; Phosphate glasses