

Synthesis and characterization of CeF₃-doped (74.5-x)P₂O₅:20Li₂O:5Al₂O₃:x(GdF₃, LaF₃ and YF₃) glasses

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Abstract

Glasses have a wide variety of applications in different types of devices, including solid-state lasers, fiber-optic amplifiers, medical imaging, radiation dosimeter, solar cells, neutron imaging, and scintillators. Among several rare-earth (RE) ions, Ce³⁺ exhibits short decay time and offers promising scintillation when it is doped in a transparent glass matrix. The objective of this study was to investigate the energy transfer from Gd³⁺, La³⁺, and Y³⁺ ions to Ce³⁺ ion in 64.5P₂O₅:20Li₂O:5Al₂O₃ glass matrix while considering an enhancement in its scintillation efficiency. Four glass samples doped with CeF₃ alone and co-doped with GdF₃, LaF₃, and YF₃ were fabricated. Broad photoluminescence and radio-luminescence emissions peaking near to 340 and 350 nm were found when excited by 310 nm and X-ray, respectively, for all the glasses. A photoluminescence emission quenching was found in LaF₃ co-doped glass. A strong energy transfer from Gd³⁺ to Ce³⁺ was noticed while the GdF₃ co-doped glass was excited by X-ray, 275 nm (from Gd³⁺), and 310 nm (from Ce³⁺) excitations. The Gd³⁺ co-doped glass consisted of a 37 ns decay constant under the 266 nm laser excitation. The thermoluminescence analysis showed two glow curves centered at 210 °C and 345 °C, respectively, after X-ray irradiation. Considering the efficient energy transfer from Gd³⁺ to Ce³⁺ ions and short lifetime of Ce³⁺ emission, the glass composition of the above formula having Gd³⁺ and Li⁺ with Ce³⁺ ions appeared to be a promising candidate in the search of good promising scintillating glasses with fast fluorescence decay time.

The full text can be found at the following link:

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