# Luminescence Characteristic of Phosphate Glasses Scintillators

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## Abstract

$Ln^{3+}$-doped phosphate glasses were successfully synthesized using the melt-quenching technique and systematically investigated with respect to their physical, optical, photoluminescence, and X-ray–induced luminescence properties for scintillator applications. An increase in $Ln^{3+}$ ion concentration led to higher density and refractive index, indicating improved structural compactness and enhanced radiation–matter interaction, which are desirable characteristics for scintillation materials. The absorption spectra exhibited similar spectral profiles with only minor variations as the $Ln^{3+}$ concentration increased, confirming that the fundamental electronic transitions of $Ln^{3+}$ ions were preserved within the phosphate glass matrix. Photoluminescence measurements revealed characteristic visible emissions originating from the intra-4f electronic transitions of $Ln^{3+}$ ions, demonstrating efficient radiative recombination processes. Enhanced emission intensity was observed at higher $Ln^{3+}$ concentrations due to the increased number of luminescent centers and the suppression of non-radiative relaxation pathways associated with reduced hydroxyl (–OH) group content. The strong visible emission was further confirmed by the CIE 1931 chromaticity diagram, indicating stable and intense luminescence. These results suggest that $Ln^{3+}$-doped phosphate glasses are promising candidates for scintillator and radiation detection applications.