The 6th International Conference on the Physics of Optical Materials and Devices

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The 5th International Workshop of Persistent and Photostimulable Phosphors

BOOK OF ABSTRACTS

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PHOTOLUMINESCENT PROPERTIES OF THE Eu^{3+} ION IN $YNbO_4$-$LuNbO_4$ SOLID SOLUTION

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Lanthanide (Ln) activated phosphors are a major topic in both basic and applied science. The trivalent europium ion (Eu^{3+}) is well recognized for its intense luminescence in the orange/red spectral region, making it useful for a wide range of applications. Because Eu^{3+} has an even number of electrons in its 4*f* shell ([Xe]4f^6), the ion has non-degenerated ground ($^7F_0$) and excited ($^5D_0$) energy states, as well as non-overlapping $^{2S+1}L_J$ multiplets, resulting in emission spectra that are predictable in relation to the host material site symmetry.

The solid-state reaction synthesis method was used to make a set of five Eu-doped $Y_xLu_{1-x}NbO_4$ samples (x=0–1) with a fixed Eu concentration (5%). All the structures crystallize as beta-Fergusonite, in which the Eu ion replaces the Y or Lu ion in a large, low-symmetry octahedron. The excitation and emission spectra of the Eu^{3+} ion in all composition hosts show characteristic *f-f* transitions from which Stark energy levels were calculated.

Specific features and energy positions of the distinctive $^5D_0 \rightarrow {}^7F_1$ magnetic dipole transition were determined when measured with higher resolution and spectra deconvolution was utilized. The maximum ΔE splitting of the $^7F_1$ manifold's Stark splitting and the asymmetry ratio R all show Y/Lu content-dependent trends.

Calculations based on Judd-Ofelt theory were utilized to determine specific quantities. The lowest non-radiative deexcitation rate was observed with x = 1, resulting in the conclusion that LuNbO4 is a better host-matrix for Eu^{3+} emission than other compositions.

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