

High-Performance Single Crystalline Film Scintillators Based on the Pr³⁺ Doped Solid Solution of Lu₃Al_{5-x}Ga_xO₁₂ Garnet

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The high-performance UV emitting scintillating screens based on the single crystalline films of Lu₃Al_{5-x}Ga_xO₁₂:Pr garnet were developed using liquid phase epitaxy (LPE) growth method onto Y₃Al₅O₁₂ (YAG) substrates using the lead-free BaO based flux. The absorbance, luminescence and scintillation properties of these SCFs were investigated depending on Ga content. We have found that the shape of CL spectra, scintillation light yield (LY) and decay kinetics of Pr³⁺ ions in Lu₃Al_{5-x}Ga_xO₁₂ SCFs are non-linearly affected by the total gallium concentration *x* due to preference in the distribution of Ga³⁺ ions between the tetrahedral and octahedral position of the garnet host. The best scintillation properties of Lu₃Al_{5-x}Ga_xO₁₂:Pr SCF are achieved at the nominal Ga content *x*=1.5 in melt-solution. The LY Lu₃Al_{3.5}Ga_{1.5}O₁₂ SCF is comparable with the LY of the best reference LuAG:Pr single crystal counterpart and significantly (up to 3 times) overcome the LY of LuAG:Pr and Lu₃Al_{3.5-3}Ga_{1.5-2} SCFs, grown on the YAG substrates from the conventional PbO-B₂O₃ flux.

Acknowledgements. The work was performed in the frameworks of Ministry of Education and Science of Ukraine SF-20F project and Polish NCN 2016/21/B/ST8/03200 and NANOLUX 2014 ID 286 projects.