INFLUENCE OF CRYSTALLITE SIZE AND MORPHOLOGY ON LUMINESCENCE PROPERTIES OF SOLVOTHERMALLY SYNTHESIZED $LuPO_4:Pr^{3+}$ NANOCRYSTALS

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The present study shows the direct solvothermal synthesis of pure tetragonal phase $LuPO_4:Pr^{3+}$ nanocrystals in DMSO-water mixed solvents. The synthesized $LuPO_4:Pr^{3+}$ nanocrystallites possess the averaged size of 9 nm (L1 sample) and 14 nm (L2 sample) by XRD, which increases to 19 nm and 23 nm, respectively, after annealing at 1000°C in inert atmosphere. The morphological and structural study revealed that both as prepared and annealed $LuPO_4:Pr^{3+}$ nanocrystals are single phase with tetragonal crystalline structure.

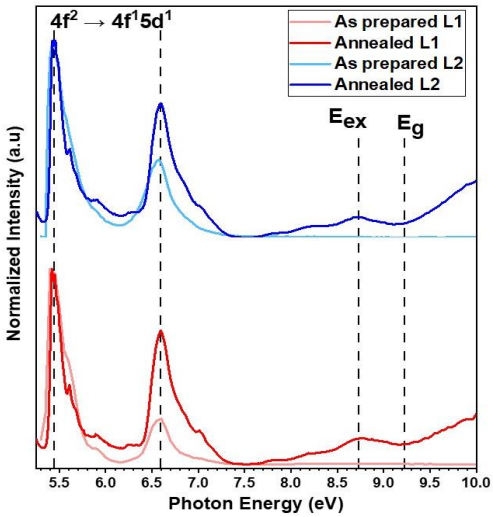

Fig.1.Integral PL excitation spectra for as prepared and annealed $LuPO_4:Pr^{3+}$ nanocrystals recorded for the $4f^15d^1 \rightarrow {}^3H_5$ luminescence at 5.06 eV at 7 K. The spectra were normalized in the maximum of the first excitation peak.

The luminescence research showed that the annealing of the $LuPO_4:Pr^{3+}$ nanocrystals results in a significant enhancement of the UV-C emission (4.4–5.5 eV) intensity under both intra-center interconfiguration $4f^2 \rightarrow 4f^15d^1$ excitation of Pr^{3+} ions and host excitation in excitonic and band-to-band transition regions. This improvement is due to the annealing induced increase of crystalline size, which improves the energy transfer processes from the host $LuPO_4$ to Pr^{3+} ion. The decay kinetic studies showed longer decay times for the annealed nanocrystals compared to as prepared ones due to reduced influence of non-radiative processes.

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