Potential Pr^{3+} doped LaOF scintillators with varying Pr^{3+} concentrations obtained from hydroxycarbonates precursors for ionizing radiation detection.

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Scintillators are materials with characteristic luminescent properties, capable of absorbing radiation at one wavelength (such as high-energy X-rays) and emitting light at another (UV–Vis–IR). Over time, various materials have been developed for use as scintillators, primarily falling into two categories: inorganic crystalline and organic. However, both classes present significant environmental concerns due to the use of toxic reagents - such as bromides, hydrofluoric acid, and thallium salts - or solvents that are hazardous or difficult to dispose of properly, including toluene, hexane, and chloroform. Lanthanides such as lanthanum can be incorporated into host matrices because they possess empty 4f orbitals - unlike other lanthanides such as praseodymium - enabling luminescent behavior.[1] This work aims to investigate the luminescence of lanthanide oxyfluorides for applications such as ionizing radiation detection, as well as to develop more efficient synthesis routes capable of producing higher-quality materials. To achieve better control over nanocrystal size and morphology, an aqueous urea solution is used as the reaction medium under constant heating and stirring to promote urea thermolysis, leading to the formation of the precursor $La(OH)CO_3:Pr^{3+}$ [2]. Scanning electron microscopy confirmed the formation of spherical nanoparticles, as shown in Figure 1. Instead of using hydrofluoric acid or concentrated ammonium fluoride solutions, the precursors undergo thermal decomposition in a tubular furnace at 900 °C under a flow of oxygen-enriched air, together with solid ammonium fluoride, to saturate the atmosphere with fluoride and obtain the corresponding oxyfluorides.

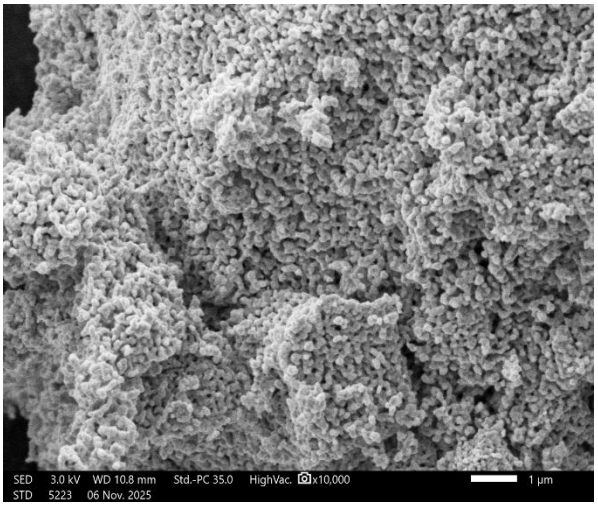

Figure 1. SEM of LaOF:Pr^{3+}at. 1.0%

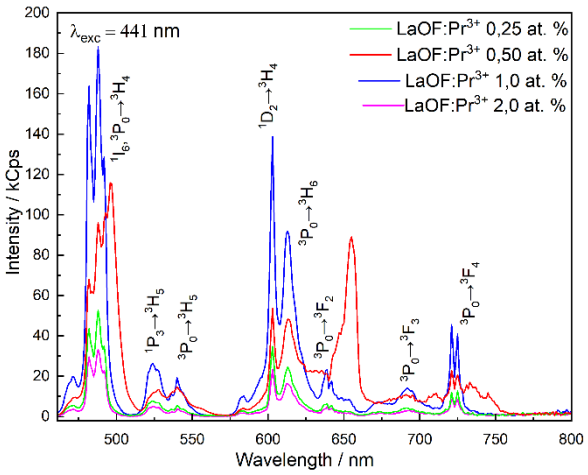

Figure 2. Comparison of the PLS curves of LaOF:Pr^{3+} at different dopant concentrations.

UV-excited photoluminescence and X-ray excited optical luminescence (XEOL) measurements were performed, with the photoluminescence spectrum (441 nm excitation) presented in Figure 2.

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