Supplementary information

Anomalous luminescence properties and cytotoxicity assessment of $Sr_3(PO_4)_2$ co-doped with $Eu^{3+/2+}$ ions for luminescence temperature sensing

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Abstract

Strontium phosphate ($Sr_3(PO_4)_2$) powders co-doped with $Eu^{2+/3+}$ optically active ions were obtained by modified Pechini's method and heat-treated at 900°, 1000° and 1100°C in air atmosphere. Structural and morphological properties of the obtained materials were investigated by the X-ray powder diffraction (XRD), Rietveld refinement method, scanning electron microscopy technique (SEM), and infrared spectroscopy (FT-IR). Emission excitation, emission, temperature dependent emission spectra, and luminescence decay time under 394.5 and 318 nm wavelength excitation were recorded and studied in detail. Moreover, the decay times of blue component were measured depending on ambient temperature. Furthermore, the $^5D_0 \rightarrow {}^7F_2$ transition is the most intense transition. Additionally, the emission of Eu^{2+} ions was detected. Mechanism of Eu^{3+} ions reduction related to heat-treated procedure was proposed and described in Kröger–Vink notation.

Cytotoxicity assay was performed on osteoblast cell line by using murine model to evaluate cytocompatibility of obtained materials. Additionally, the hemocompatibility properties were evaluated by using hemoglobin release assay and normal morphology of erythrocytes membrane was visualized by confocal microscopy after 24 hours of incubation with obtained materials.

***Keywords*:** Luminescence, Strontium phosphate, $Sr_3(PO_4)_2$, Europium(II, III) ions, Biomaterial, Cytotoxicity, Osteoblast cell line, Hemolysis assay

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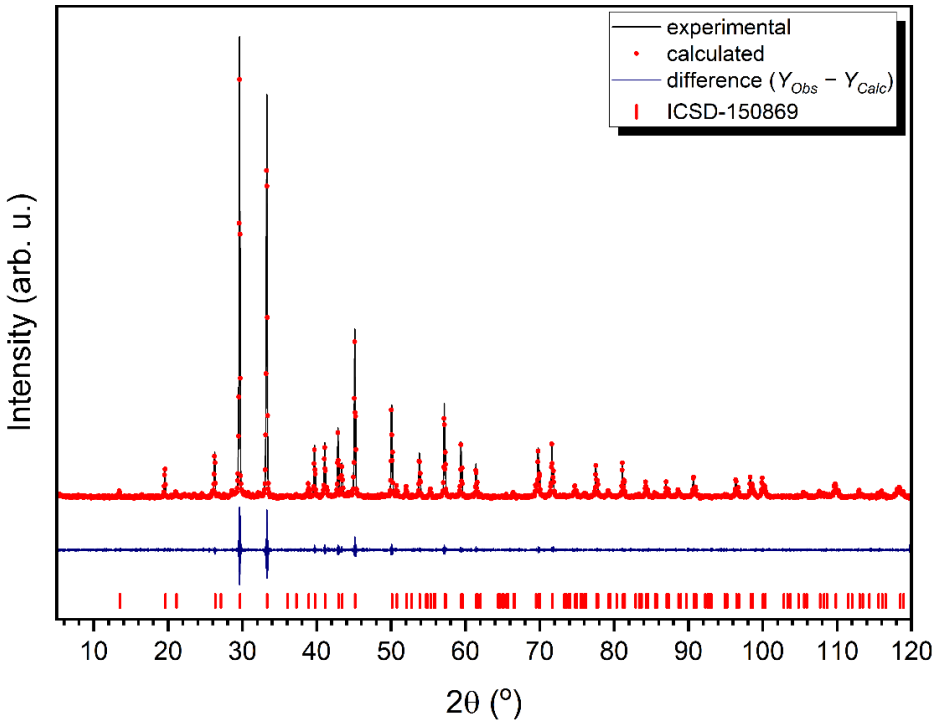

Figure S1. Rietveld analysis for the $Sr_3(PO_4)_2$ obtained at 900 °C, (red – fitted diffraction, blue – differential pattern, and column – reference phase peak position).

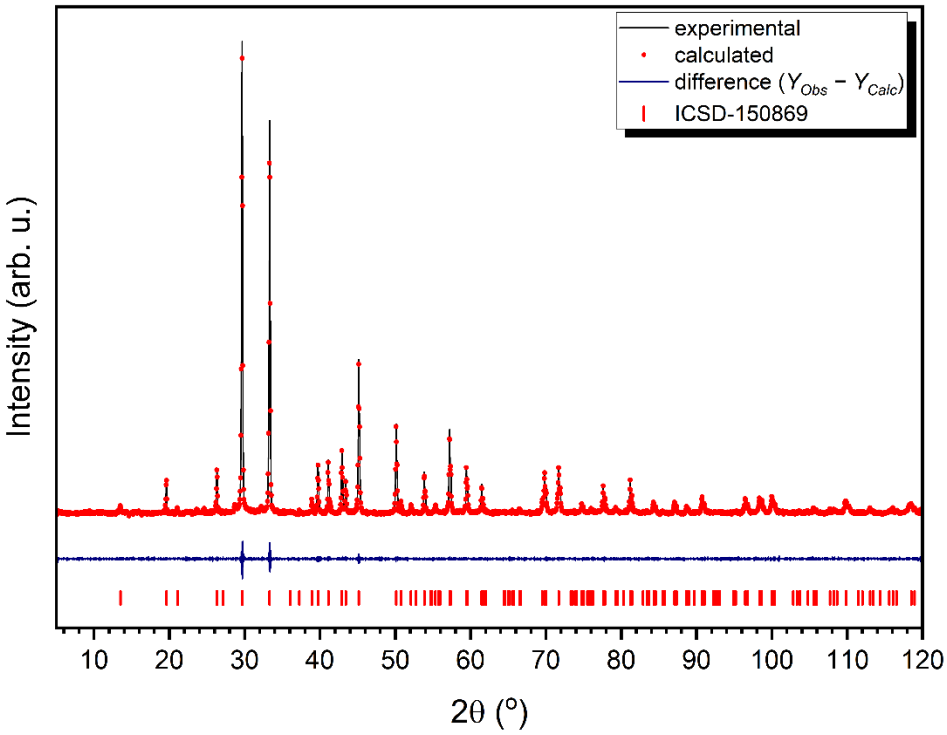

Figure S2. Rietveld analysis for the 0.5 mol% $Eu^{2+/3+}$:$Sr_3(PO_4)_2$ obtained at 900 °C, (red – fitted diffraction, blue – differential pattern, and column – reference phase peak position).

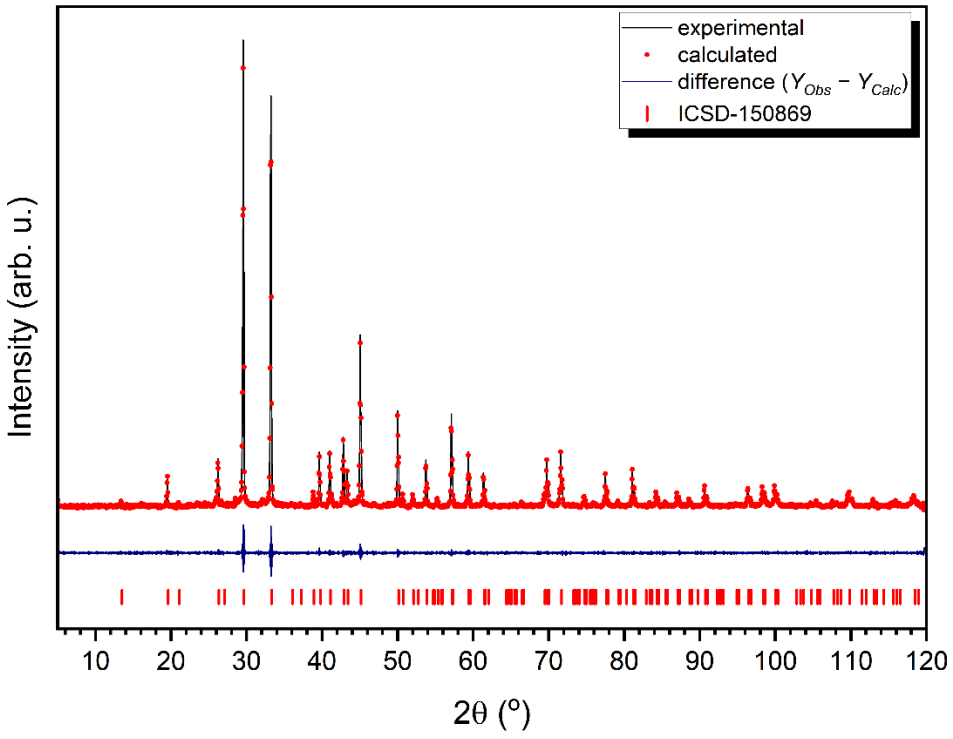

Figure S3. Rietveld analysis for the 1 mol% $Eu^{2+/3+}$:$Sr_3(PO_4)_2$ obtained at 900 °C, (red – fitted diffraction, blue – differential pattern, and column – reference phase peak position).

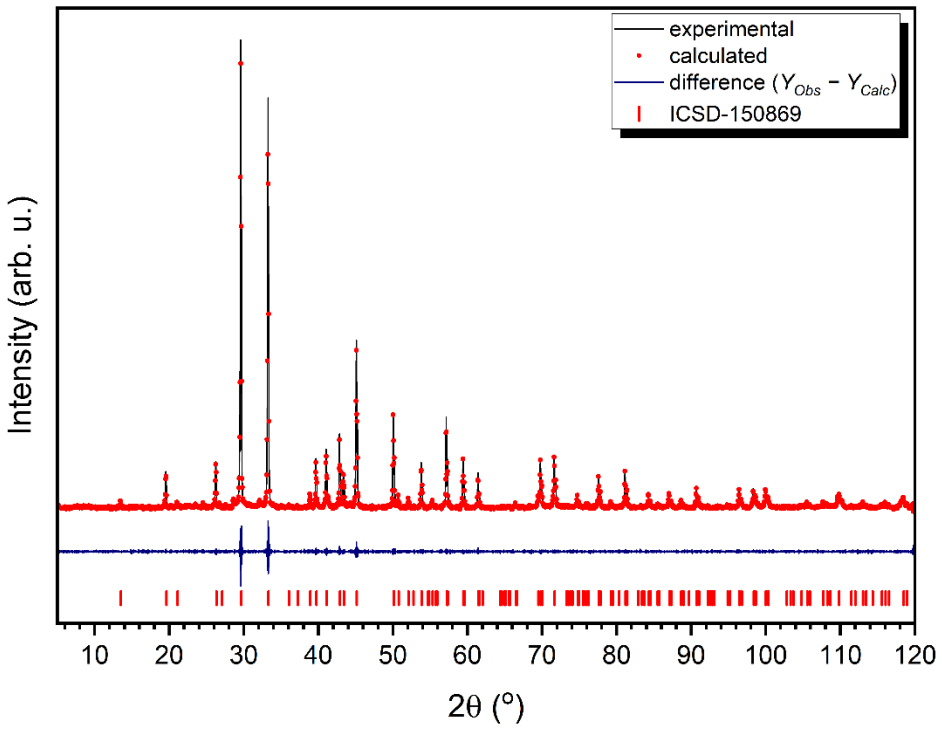

Figure S4. Rietveld analysis for the 2 mol% $Eu^{2+/3+}$:$Sr_3(PO_4)_2$ obtained at 900 °C, (red – fitted diffraction, blue – differential pattern, and column – reference phase peak position).

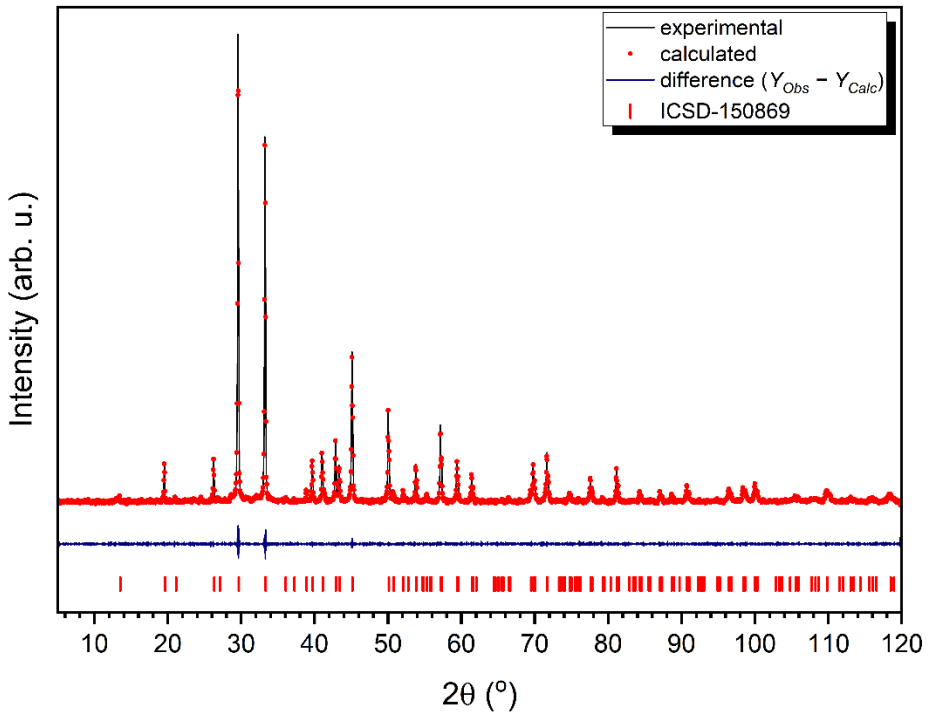

Figure S5. Rietveld analysis for the 3 mol% $Eu^{2+/3+}$:$Sr_3(PO_4)_2$ obtained at 900 °C, (red – fitted diffraction, blue – differential pattern, and column – reference phase peak position).

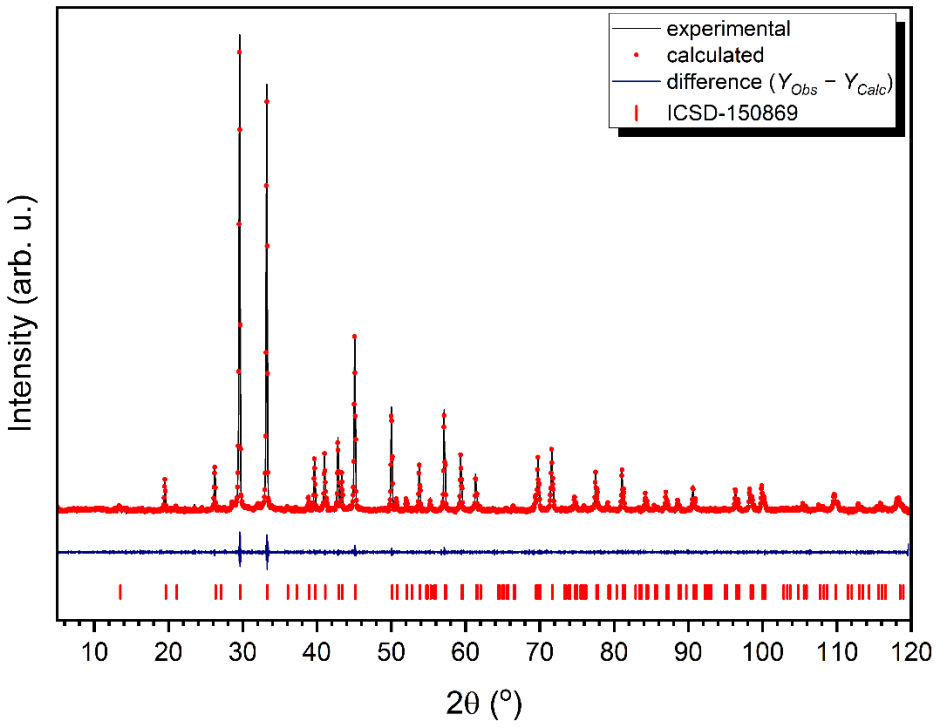

Figure S6. Rietveld analysis for the 2 mol% $Eu^{2+/3+}$:$Sr_3(PO_4)_2$ obtained at 1000 °C, (red – fitted diffraction, blue – differential pattern, and column – reference phase peak position).

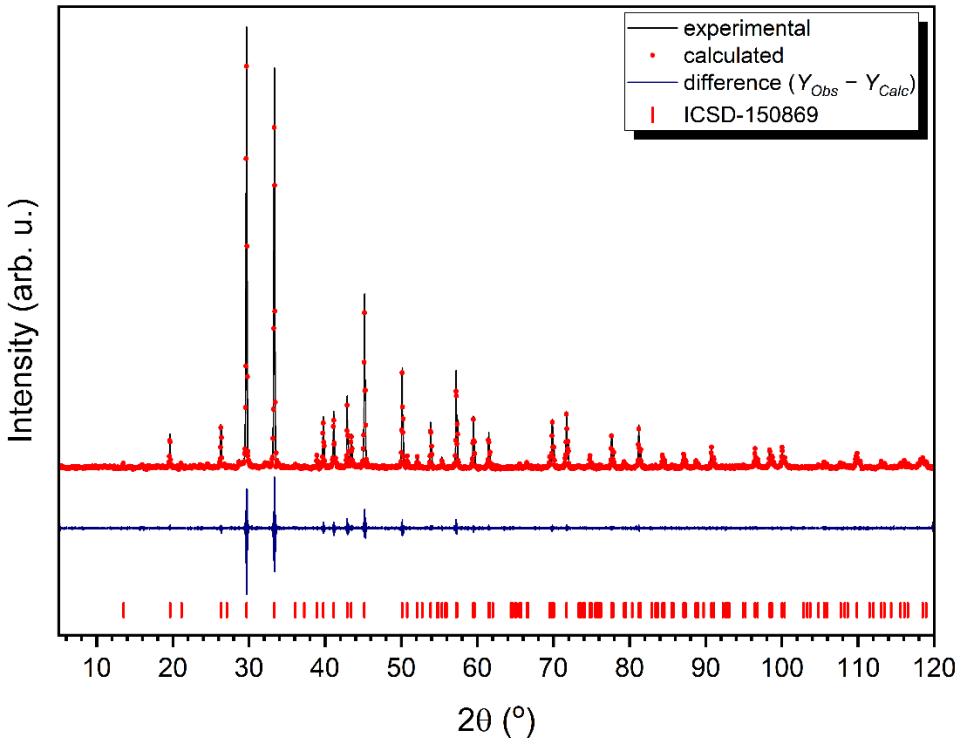

Figure S7. Rietveld analysis for the 2 mol% $Eu^{2+/3+}$:$Sr_3(PO_4)_2$ obtained at 1100 °C, (red – fitted diffraction, blue – differential pattern, and column – reference phase peak position).