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Cooperative Energy Transfer and Upconversion Luminescence of Sr5(PO4)3OH:Eu3+,Yb3+ phosphor powders

In this study, strontium hydroxyapatite (Sr5(PO4)3OH) doped with europium (Eu³⁺) and ytterbium (Yb³⁺) were successfully synthesized by combustion method. The structural, morphological, and optical properties of the phosphors were determined using X-ray diffraction (XRD), high resolution scanning electron microscopy (HRSEM), energy dispersive X-ray spectroscopy (EDS), and photoluminescence (PL) spectroscopy. XRD data confirmed crystallization of pure hexagonal phase of Sr5(PO4)3OH and HRSEM revealed a network of particles with irregular shapes having small bright particles encrusted on the surface of the bigger particles. The EDS analysis confirm that bright particles were dominated by rare earth elements, while darker particles are primarily composed of the host material. Upon UV excitation, prominent orange emission and minor red emission peaks corresponding to Eu3+ transitions were observed. The red emission was enhanced significantly upon co-doping with Yb³⁺, which facilitated non-radiative energy transfer from Yb³⁺ to Eu³⁺. The enhanced red upconversion luminescence of Sr5(PO4)3OH:Eu³⁺,Yb³⁺ phosphors shows promising potential for applications in photodynamic therapy (PDT).

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