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Study on the impact of Pr^{3+} , Ce^{3+} , and Pb^{2+} ions on luminescence properties of $\text{BaB}_8\text{O}_{13}:\text{Gd}^{3+}$ for potential applications in phototherapy.

A series of $\text{BaB}_8\text{O}_{13}$ phosphors doped with different concentrations of (2.0 mol.%) Gd^{3+} ions and 1.0 mol.% co-doped with Pr^{3+} , Pb^{2+} , and Ce^{3+} ions were synthesized by solid-state synthesis method. The X-ray powder diffraction (XRD) analysis confirmed the pristine crystalline structure and uniformity of the compounds, with an average crystalline size of around 33 - 45 nm. Scanning Electron Microscopy (SEM) was performed to study the surface morphology of the compound and Fourier Transform Infrared (FT-IR) spectroscopy measurements determined the nature of bonding between elements of the compounds. The photoluminescence (PL) excitation spectra of $\text{BaB}_8\text{O}_{13}:\text{Gd}^{3+}$ phosphor showed excitation peaks at 274 nm. The crucial role of gadolinium (Gd^{3+}) ions in barium-based hosts lies in their narrowband emission spectrum, specifically at 311–315 nm, which is in narrow band ultraviolet B (NB-UVB) range and is attributed to the $^6\text{P}_{7/2}$ to $^8\text{S}_{7/2}$ transition and the prominent emission peak was observed at 340 nm that could result in oxygen vacancy from the $\text{BaB}_8\text{O}_{13}$. The effects of co-doping Pr^{3+} , Pb^{2+} and Ce^{3+} ions with Gd^{3+} ions were observed. Emission at 313 nm can be used for the treatment of skin diseases. Based on phosphor host materials in Gd^{3+} activated materials or through energy transfers from sensitized dopant ions, enhanced PL emissions that are observed are pertinent for treatments of many skin diseases such as psoriasis, vitiligo, eczema, and many other skin conditions.

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None

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