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Investigation of red-emitting $\text{Bi}_4\text{Si}_3\text{O}_{12}:\text{Eu}^{3+}$ phosphor under the deep UV irradiation as a novel material for white light and color tunable emission

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Abstract

$\text{Bi}_4\text{Si}_3\text{O}_{12}:\text{Eu}^{3+}$ phosphors are synthesized by a solvothermal reaction method. The structural properties are investigated using the X-ray diffraction patterns, which confirmed the cubic phase with a space group I-43d. The optical properties are studied by the measurement of diffused reflectance, excitation and emission spectra. The photoluminescence (PL) excitation spectra of $\text{Bi}_4\text{Si}_3\text{O}_{12}:\text{Eu}^{3+}$ phosphor exhibits a broad band between 220 and 350 nm with two peaks occurring around 271 and 297 nm corresponding to the host absorption and charge transfer bands, respectively, and several sharp peaks due to the f-f transitions of Eu^{3+} ions in the wavelength over 350 nm. The PL spectra exhibit blue emission due to the $^1\text{S}_0 \rightarrow ^3\text{P}_1$ transition of Bi^{3+} and red emission due to the $^5\text{D}_0 \rightarrow ^7\text{F}_2$ transition of Eu^{3+} . With increase of Eu^{3+} concentration, blue emission decreased and red emission increased. At the concentration of 3 mol% Eu^{3+} , $\text{Bi}_4\text{Si}_3\text{O}_{12}:\text{Eu}^{3+}$ phosphors show white emission with the CIE chromaticity coordinates ($x = 0.345$, $y = 0.327$). These results suggest that the $\text{Bi}_4\text{Si}_3\text{O}_{12}:\text{Eu}^{3+}$ phosphors are

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