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Eu3+ doped Al2(WO4)3 for red-emitting phosphors applications

Since the discovery of the red light-emitting diode (R-LED) by Nick Holonyak in 1962, LEDs have become indispensable in many everyday applications, from lighting on display screens and smartphones, to laser diodes, even in specialized lighting in horticulture. In this direction, tungsten-based compounds are very attractive due to their high thermal stability greater than 800 ℃ and their high dopant solubility. Thus, in the present work reports the synthesis of Al2(WO4)3 doped Eu3+ through a double substitution reaction by solvothermal evaporation technique. The Structural characterization by X-ray diffraction patterns presents well-defined high intensity peaks related to the orthorhombic phase of Al2(WO4)3, according to chart PDF-70-4478, with a crystallite size of 29.0 nm calculated using the Scherrer equation. The Raman spectroscopy confirms that the main vibrational modes are located in 1052 cm-1 related at WO_4^(2-) units. The excitation spectrum monitoring the emission at 613 nm (5D0 ⟶ 7F2) presents seven excitation bands, one related to O-2 ⟶ W6+ charge transfer and the other six to the characteristic excitation bands of Eu3+: 7F0 ⟶ 5D4, 5L7, 5L6, 5D3, 5D2, 5D1 and 5D0. On the other hand, the emission spectrum was measured under an excitation wavelength of 394 nm (7F0 ⟶ 5L6). The emission spectra present five bands emission related to Eu3+: 5D0 ⟶ 7F0, 7F1, 7F2, 7F3 and 7F4. The intensity between the different J levels relies on the symmetry of the local environment of Eu3+ ion and is evaluated as described in the literature. Finally, the color purity is evaluated through emission spectra in the CIE1931 protocol, obtaining color purities above 97%. The correlation results indicate that the Eu3+-doped Al2(WO4)3 is suitable for LED applications.

Keywords

Luminescence, Phosphors, Europium, Tungstate, Aluminium

Reference

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