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Luminescent properties of Dy3+ doped Al2(WO4)3 for modular white light applications

The present work synthesized Al2(WO4)3 activated with Dy, using the solvent evaporation methodology. Deionized water was used as a solvent, AlCl3, DyCl3 and Na2WO4 as reagents; Then it was subjected to heat treatment at 400°C for 2 hours. The X-ray diffraction patterns present high intensity peaks related to the orthorhombic phase of Al2(WO4)3, according to letter PDF-70-4478. With a crystallite size of 29.0 nm calculated using the Scherrer equation. Raman spectroscopy indicates that the main vibration modes are, located in, all related to the vibration modes of WO4 units. From the Kubelka-Munk approximation, a direct and indirect forbidden gap energy was estimated with values of 4.61 and 3.38 eV, respectively. Excitation spectroscopy monitoring the emission at 575nm, exhibits an excitation band at 255 nm related to the 1A1⟶1T1+1T2 level associated with the WO4 units. In addition, the characteristic excitation bands of the Dy ion located at 325, 352, 366, 387, 424, 453 and 473 nm. From the excitation spectrum, the wavelengths 255 and 350 nm were selected as excitation lines to obtain the emission spectra. For the excitation wavelength of 255 nm, the emission spectrum presented an emission band related to the 1A1⟶1T1+1T2 level of WO4 units at 395 nm. Likewise, the characteristic emission bands of the Dy ion related to the levels can be seen. On the other hand, under an excitation wavelength of 350 nm the emission related to the 3T1+3T2⟶1A1 level of WO4 units at 395 nm is overshadowed by the high intensity of the Dy ion emissions described previously. Finally, from the emission spectra, the color coordinates are evaluated in the CIE1931 protocol. It starts with a bluish white emission for the matrix, followed by emission tones ranging from cold white, neutral white and concluding in yellow tones according to the increase in the Dy content.

Keywords

: Luminiscence, lanthanide, WO4, Dy3+, CIE1931

Reference

Batista, F. M. C., et al. “A joint experimental and theoretical study on the electronic structure and photoluminescence properties of Al2 (WO4) 3 powders.” Journal of Molecular Structure 1081 (2015): 381-388.

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Author approval

I confirm

Author will attend

I confirm

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