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Structural adjusting and luminescence property refinement of $NaSr_2Nb_5O_{15}$:0.03Eu^{3+} phosphors

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Tetragonal tungsten bronze type $NaSr_2Nb_5O_{15}$ offers two kinds of sites with different symmetries for Eu^{3+} occupying. Based on the selected rules of Eu^{3+} ionic radiative transition, the luminescence properties of $NaSr_2Nb_5O_{15}$: 0.03Eu^{3+} phosphors could be refined by adjusting the symmetries of crystal structure. In this work, $NaSr_2(1-x)Nb_5O_{15}$: 0.03Eu^{3+} (x=0, 0.02, 0.04, 0.06, 0.08) phosphors were prepared via traditional solid state reaction method. The effects of absent Sr^{2+} on the crystal structure and luminescence properties was investigated. The phase structures, morphologies, elements, and luminescence properties were characterized by the X-ray diffractometer (XRD), Scanning electron microscopy (SEM), Energy dispersive spectroscopy (EDS) and Photoluminescence spectroscopy (PL). The results confirmed that the distortion of [NbO6] octahedrons increased with the absence of Sr^{2+}, whereas the symmetries of the sites occupied by Eu^{3+} decreased. Following the adjustment of structure, the relative intensity of magnetic-dipole transition ($^5D_0 \rightarrow {}^7F_1$) could be reduced (~6%), and more excited electrons release energy through electric-dipole transition ($^5D_0 \rightarrow {}^7F_2$). This work suggested a route for using lattice structural adjustment to refine luminescence properties of tungsten bronze type phosphors.

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