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Luminescence properties of Dy^{3+} or/and Sm^{3+} doped $LiLa(WO_4)_2$ phosphors and energy transfer from Dy^{3+} to Sm^{3+}

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Abstract:

The Dy^{3+} or/and Sm^{3+} doped $LiLa(WO_4)_2$ phosphors are synthesized by a facile solid state reaction method. The phase and luminescence properties of the phosphors are investigated. The powder X-ray diffraction (XRD) results show that the phosphor has a tetragonal phase crystal structure. The quenching concentration of single doped Dy^{3+} and Sm^{3+} in the $LiLa(WO_4)_2$ are determined to be 6% and 3%, respectively. Under the excitation of 404 nm, warm white light is obtained in the co-doped phosphors. With the concentration of Sm^{3+} increasing, the correlated color temperature (CCT) gradually decreases from 3090 to 2453 K. Two kinds of energy transfer may exist at the same time. The overlap between the emission spectrum of Dy^{3+} and the excitation spectrum of Sm^{3+} reveals that the energy of Dy^{3+} can transfer to Sm^{3+} via radiation. Another way of energy transfer, that is non-radiative energy transfer, is attributed to the excited state of Dy^{3+} ($^4F_{9/2}$) slightly higher than that of Sm^{3+} ($^4I_{19/2}$). The calculation results show that non-radiative energy transfer process from Dy^{3+} to Sm^{3+} ions is predominated by quadrupole–quadrupole interaction.

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