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Photoluminescence enhancement of novel $\text{K}(\text{Y,Lu})\text{CaWO}_6\text{: Eu}^{3+}$ red phosphor prepared by controllable citrate-EDTA complexing method

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Abstract:

Novel double-perovskite $\text{K}(\text{Y}_{0.95-x}\text{Lu}_x\text{Eu}_{0.05})\text{CaWO}_6$ red phosphors were successfully prepared by the controllable citrate-EDTA complexing method. XRD with structure refinement, FTIR, Raman and photoluminescence spectra were combined to systematically investigate the structure parameters and luminescence properties of prepared phosphors. The substitution of Lu^{3+} with smaller ionic radius resulted in the lower symmetry even with the same space group of $C2/m$, which was also directly observed from the red shift and splitting of Raman $T_{2g}(1)$ mode. The concentration higher than $x=0.6$ made the intensity alteration in the excitation spectra from charge transfer band to $4f-4f$ of Eu^{3+} . The obvious enhancements of red emission at 615 nm were obtained under both blue and ultraviolet lights, respectively, and reached almost the same intensity at $x=0.6$. Meanwhile, the more standard red light could be found by the gradual shifts of CIE chromaticity coordinates and bigger ratio of red/orange emission. The substitution of Lu^{3+} improved the quality and emission intensity of red light of this double perovskite system and the composition optimized phosphor of $\text{K}(\text{Y}_{0.35}\text{Lu}_{0.6}\text{Eu}_{0.05})\text{CaWO}_6$ exhibited great potential in the application of white LEDs.

Keywords: Double perovskite; controllable citrate-EDTA complexing method; symmetry; phosphors; white LEDs

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