LUMINESCENCE PROPERTIES OF $K_5Eu(MoO_4)_4$

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The present work reveals the energy transfer processes that occur in the $K_5Eu(MoO_4)_4$ crystal grown by the Czochralski method. The experimental results obtained by various spectroscopic techniques showed that the material exhibits several emission bands of different intensities in the 520-720 nm region. The observed emission lines are attributed to the intra-configurational 4f-4f transitions in Eu^{3+} ions [1]. The most pronounced emission line appeared at 615 nm with a decay time of 1.4 ms. Furthermore, the high-resolution emission spectrum has revealed that Eu^{3+} ions occupy crystallographic positions of one type with orthorhombic symmetry [2]. Temperature dependence studies showed that the Eu^{3+} emission intensity and decay time are stable up to 400 K when excited within the 4f-4f Eu^{3+} energy transitions. However, the luminescence intensity decreased rapidly under inter-band excitations due to an inefficient energy transfer from MoO_4 complex to Eu^{3+} ions. Furthermore, temperature dependence measurements also revealed the possibility of thermal population of Eu^{3+} $^7F_1$ ground and $^5D_1$ excited levels. Based on the obtained results, it is assumed that $K_5Eu(MoO_4)_4$ has promising luminescence characteristics under excitation in the near-UV spectral range and can be used as a red phosphor for solid-state lighting applications.

References

1. *K. Binnemans, Interpretation of europium(III) spectra, Coordination Chemistry Reviews. 295 (2015) 1–45. https://doi.org/10.1016/j.ccr.2015.02.015.*
2. *G. Huber, W. Lenth, J. Lieberts, F. Lutz, Electric dipole transition cross sections and effective site symmetry of Eu^{3+} in pseudocentric $K_5Eu(MoO_4)_4$, Journal of Luminescence. 16 (1978) 353–360. https://doi.org/10.1016/0022-2313(78)90080-7.*

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