DIFFUSE REFLECTANCE SPECTROSCOPY OF (Y,Me)NbO4:Er,Yb PHOSPHORS (Me = In, Al)

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Abstract
Yttrium niobate ($YNbO_4$) is a self-activated phosphor exhibiting intense blue-band emission, with additional red and green emissions when doped with selected rare-earth ions. In this study, diffuse reflectance spectroscopy (DRS) was employed to investigate the electronic transition bands, optical band gap, and the influence of trivalent dopant ions (Me^{3+} = In^{3+}, Al^{3+}) on these properties. Nanocrystalline (Y,Me)NbO_4:Er^{3+},Yb^{3+} powders were synthesized via a solid-state reaction in a planetary ball mill (100 rpm, 8 h), followed by pre-annealing at 800 °C for 4 h and final annealing at 1200 °C for 4 h. Er^{3+} and Yb^{3+} ions were introduced to facilitate up-conversion (UC) luminescence, functioning as activator and sensitizer ions, respectively. Dopant Me^{3+} ions were incorporated to partially substitute Y^{3+} in the host lattice, thereby inducing local structural distortions and modifying the optical environment [1]. Microstructural characterization was carried out using *X*-ray diffraction (XRD) and scanning electron microscopy (SEM). DRS revealed characteristic Er^{3+} absorption bands, corresponding to the $^4I_{15/2} \rightarrow {}^2H_{11/2}$, $^4S_{3/2}$, $^4F_{9/2}$, and $^4I_{9/2}$ transitions, consistent with those observed in the up-conversion emission luminescence spectra. The optical band gap, estimated from the DRS data using the Kubelka-Munk function, was approximately 3.7 eV [2].

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References
[1] X. Wang, X. Li, H. Zhong, S. Xu, L. Cheng, J. Sun, J. Zhang, L. Li, B. Chen, *Sci. Rep.* 8 (2018) 5739(13pp).
[2] A.B. Garg, D. Vie, P. Rodriguez-Hernandez, A. Muñoz, A. Segura, D. Errandonea, J. *Phys. Chem. Lett.* 14, (2023) 1762(7pp).