materials

MDPI

Article

Effects of impurity doping on the luminescence performance of Mn^{4+}-doped aluminates with the magnetoplumbite-type structure for plant cultivation

Xiaoshuang Li [1], Zikun Chen [1], Bo Wang [1,*], Ruizhao Liang [1], Yongting Li [1], Lei Kang [1] and Pengfei Liu [2]

[1] School of Applied Physics and Materials, Wuyi University Jiangmen, Guangdong 529020, P.R. China; wangbo312@mails.ucas.ac.cn (B. Wang)

[2] Dongguan Neutron Science Center, Dongguan 523803, PR China

* Correspondence: wangbo312@mails.ucas.ac.cn (B. Wang)

Supplementary Materials

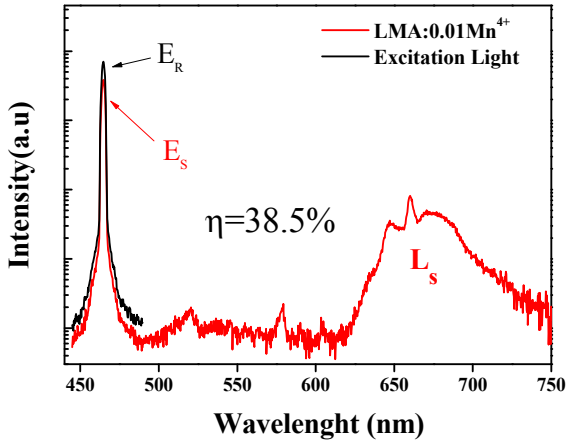


Figure. S1. The quantum efficiency of the LMA:0.01Mn^{4+} phosphor.

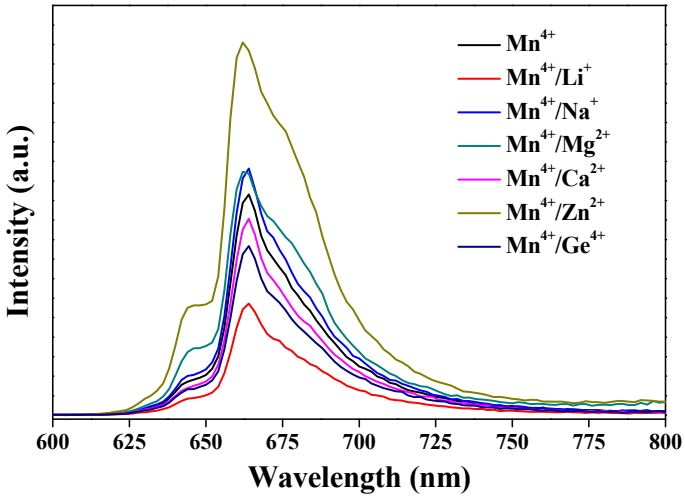


Figure. S2. PL spectra of LMA:0.01Mn^{4+}, 0.01M^{+} powder.

Calculation of crystal field parameters of Dq, B, and C

The values of Dq, B, and C can be calculated based on experimentally determined energy levels using the following equations:[1,2]

$$Dq = E(^4T_{2g} - {}^4A_{2g})/10 \quad (1)$$

$$\frac{Dq}{B} = \frac{15(x-8)}{(x^2-10x)} \quad (2)$$

$$x = \frac{E(^4A_{2g} \rightarrow {}^4T_{1g}) - E(^4A_{2g} \rightarrow {}^4T_{2g})}{Dq} \quad (3)$$

$$E(^2E_g - {}^4A_{2g})/B = 3.05C/B + 7.9 - 1.8B/Dq \quad (4)$$

where ΔE is the energy difference between $^4T_{2g}$ and $^4T_{1g}$. The energy levels of $^4T_{2g}$, $^4T_{1g}$, and ^2E_g were determined at 21505, 25316, and 15083 cm^{-1}. From equations (1)-(4), the values of Dq, B, and C in the CMA: Mn^{4+} are then determined to be 2150 cm^{-1}, 321 cm^{-1}, 4076 cm^{-1}, respectively.

Reference

1. Henderson, B.; Imbusch, G.F. Optical spectroscopy of inorganic solids. Oxford University Press, **1989**.
2. Reisfeld, M.J.; Natwiyoff, N.A.; Asprey, L.B. The electronic spectrum of cesium hexafluoromanganese (IV). *J. Mol. Spectrosc*. **1971**, 39, 8–20.



© 2018 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).