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Ling Xiao, Jian Zhou, Guizhen Liu, Lin Wang

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Luminescent properties of R^+ doped $Sr_2MgSi_2O_7$: Eu^{2+}, Dy^{3+} (R^+ = Li^+, Ag^+) phosphors

Ling Xiao [a], Jian Zhou [a, *], Guizhen Liu [a], Lin Wang[b]

a State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology, Wuhan, 430070, P. R. China

b Key Laboratory of Fiber Optic Sensing Technology and Information Processing, Ministry of Education, Wuhan University of Technology, Wuhan 430070, P. R. China

* Author for correspondence, E-mail addresses: jianzhou@whut.edu.cn, Contact Number: +86-27-87884448

Abstract: Long afterglow phosphor $Sr_2MgSi_2O_7$: Eu^{2+}, Dy^{3+} doped with R^+ (R^+ = Li^+, Ag^+, respectively) was synthesized by the high temperature solid-state reaction method. Crystal structure, morphological and luminescent properties were analyzed by X-ray diffraction (XRD), scanning electron microscope (SEM), photoluminescence (PL), decay curves and thermoluminescence (TL) curves. The results indicate that the incorporation of these metal ions have no influence on the position of the emission peak which is determined by the $4f^7 \rightarrow 4f^6 5d^1$ Eu^{2+} ions, but have influence on the intensity of the emission and the afterglow. The highest phosphorescent intensity was observed with 2.5 mol% of Li^+, and 0.4 mol% of Ag^+ doping in respectively. Compared with the undoped sample, the optimum incorporation of Li^+ ions could induce a remarkable increase of phosphorescent intensity and the decay constant by about 1.5 times and 1.6 times, respectively. Doping Ag^+ ions can also improve the luminescence properties, but the performance is not good as Li^+ ions. The mechanism of $Sr_2MgSi_2O_7$: Eu^{2+}, Dy^{3+}, R^+ (R^+ = Li^+, Ag^+, respectively) enhancement has been discussed.

Keywords: $Sr_2MgSi_2O_7$: Eu^{2+}, Dy^{3+}; lithium ion; silver ion; luminescent properties