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Highly capable non-rare earth doped LiMgBO₃ phosphor for light emitting diodes

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Non- rare earth doped phosphor materials particularly Mn⁴⁺ activated nitrides and fluorides are emerging as an alternative to rare earth doped red emitting phosphor materials for light emitting diodes, as these materials are more cost effective. Still it remains a challenge to prepare high purity red light emitting and cost effective non-rare earth doped red phosphors because of the broad emission and challenging synthesis of nitrides and fluorides, respectively. Herein we reported the red emitting Mn⁴⁺ doped LiMgBO₃ phosphor synthesized by solution combustion and solid state route. The photoluminescence spectrum had two broad bands from 260–410 nm and 420-545 nm, due to the ⁴A₂ → ⁴T₁ and ⁴T₂ transition of Mn⁴⁺, respectively. Under UV and visible excitation the phosphor emits at 665 nm with CIE chromaticity coordinates of (0.706, 0.292) and FWHM of 35 nm, which revealed the high purity red light emission from the phosphor. The concentration quenching of Mn⁴⁺ was observed at around 0.6 mol%. The predicted mechanism for concentration quenching to be a dipole–dipole interaction among the Mn⁴⁺ ions. The results suggests that the phosphor with enough color purity ˜62% and stable CIE coordinates could be an eventual choice as the red component for white light emitting diodes.

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