Enhanced luminescence properties of low-cost Mn²⁺doped willemite based glass– ceramics as potential green phosphor materials

ABSTRACT

Low-cost Mn^{2+} -doped willemite (α -Zn₂SiO₄:Mn²⁺) based glass–ceramics were synthesized by conventional melt–quenching technique using waste soda lime silica (SLS) glasses, zinc oxide (ZnO) and Manganese oxide (MnO) as precursors. The effect of different MnO percentage doping on physical, structural, optical and luminescent performance α -Zn₂SiO₄:Mn²⁺ based glass–ceramics were comprehensively studies in this work. The presence of α -Zn₂SiO₄:Mn²⁺ crystal phase and microstructure was confirmed by X-ray diffraction and field emission scanning electron microscopy spectroscopy. From the Scherrer's formula, α -Zn₂SiO₄:Mn²⁺ have an average crystallite size of 30–40 nm, respectively. Fourier transform infrared reflection spectroscopy displays the structural growth of α -Zn₂SiO₄:Mn²⁺ crystal. The green emission centered at about 527 nm from the α -Zn₂SiO₄:Mn²⁺ crystal exhibit a resulted from ⁴T₁–⁶A₁energy transition of Mn²⁺ ions. Intense emissions of Mn²⁺ ions at 260 nm excitation were occurs may be caused by the increase of Mn²⁺ ions into α -Zn₂SiO₄:Mn²⁺ based glass–ceramic exhibit a huge potential to act as a green phosphor in opto-electronic devices.

Keyword: Manganese oxide; Glass frit; Willemite; Zn2SiO4; Green phosphor