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Structural and upconversion properties of Er3+/Yb3+ doped zinc titanate for potential applications in bio-imaging

ABO3 perovskite materials are gaining interest due to their applications in materials, electronics, and photovoltaics [1]. One type of ABO3 is ZnTiO3, this material is highly favored because of its outstanding mechanical, optical, and insulating properties [2, 3]. It has been applied in various applications such as paint pigments, sorbents, microwave dielectrics, catalysts, dielectric materials, solar cells, photocatalysis, antibacterial agents, and gas sensors [4, 5, 6, 7]. Upconverting nanomaterials are used in a variety of applications, mostly in displays, the visualization of biological objects, data storage, lasers, sensors, optical imaging, and photodynamic therapy or in the development of solar panels, to name a few [8, 9, 10].
In this study, the host material zinc titanate and Yb3+/Er3+ doped ZnTiO3 was synthesized using the Hoodia Gordonii ethanoic extract.
The XRD showed that hexagonal Ecandrewsite structure was synthesized with the most intense peak corresponding to ZnTiO3 at around 2θ=35° [110], the intensity of the peaks reduced with doping concentration, and a peak shift was observed indicating incorporation of dopant. Raman results confirmed the production of ZnTiO3 and the peak shift due to dopant atoms occupying the lattice sites. The most intense vibrational mode at 350 cm-1 corresponds to the Ag mode of ZnTiO3; this agrees with the XRD phase analysis. The SEM micrographs showed a mixture of highly agglomerated morphologies ranging from platelets to rods, this is consistent with the formation of mixed-phase particles. The upconversion measurements showed a green emission centered around 550 nm, and this was confirmed by the CytoViva microscope. The upconversion properties of this material show that it has a potential use in bio-imaging and photodynamic therapy.

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