Near-Infrared emitting Cr^{3+}-doped Mixed Oxide Luminescent Materials for Optical Imaging

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The rapid growth of optical imaging in the latest years proposes novel alternatives to well-established imaging techniques, in a way that current research interest within this field is now focused on the design of efficient photonic materials and optical sensors[1-2]. In this scenario, this work presents the development of Cr^{3+}-doped Zn/Mg/Sn mixed oxides prepared *via* solid-state and microwave synthesis, exhibiting interesting spectroscopic properties in the red to near-infrared (NIR) range. Prepared compounds were analyzed by PXRD, where the obtained diffraction profiles followed mainly the overlapping Mg_2SnO_4 and Zn_2SnO_4 patterns, and crystallite size was estimated to be about 70 nm. SEM/EDS analysis revealed micrometer-sized particles up to 20 μm, but much smaller particles and homogeneous Cr^{3+} distribution were also observed. Moreover, Synchrotron radiation measurements obtained at the Brazilian Synchrotron Light Laboratory, on the TGM beamline *via* Vacuum UV Spectroscopy within the 4.5–7.5 eV energy range revealed distinct emission profiles with increasing Zn concentration, affecting the contribution of deep-red and NIR vibronic sidebands at 700 and 720 nm, respectively. Still, maximum absorption energies (about 6.6 eV) remained constant for all the analyzed compounds, whereas the broad-band NIR emission of Cr^{3+} ion centered around 770 nm assigned to the [$^4T_2(t^2e) \rightarrow {}^4A_2$] transition is predominant. Persistent luminescence decay curves under near-band gap excitation were also probed. Thus, in this work, we demonstrated an effective way to assemble NIR emitting luminescent materials with potential applications in optical imaging and photonics, where similar and expensive Cr^{3+}-doped gallates are already widely explored.

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References:

[1] M. N. Silva, *et al*., *Appl. Nano Mater*., **2**, 6918−6927 (2019).
[2] N. Basavaraju, *et al*., *Phys. Chem. Chem. Phys*., **19**, 1369-1377 (2017).