

# Spectroscopic investigation of luminescence in Cr<sup>3+</sup>-doped Sr<sub>2</sub>Ga<sub>(1-x)</sub>In<sub>x</sub>SbO<sub>6</sub> double perovskite

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Cr<sup>3+</sup>-doped materials have attracted significant attention as broadband near-infrared emitters due to their characteristic d-d transitions and strong dependence on the local crystal field. The spectroscopic properties of Cr<sup>3+</sup>-doped Sr<sub>2</sub>Ga<sub>(1-x)</sub>In<sub>x</sub>SbO<sub>6</sub> double perovskites were investigated as a function of composition and temperature. Optical absorption measurements revealed a host band-to-band transition, with the band gap systematically decreasing with increasing indium content, indicating modifications of the electronic structure. Photoluminescence studies showed a broad emission band typical of Cr<sup>3+</sup> ions in a weak crystal field, attributed to the spin-allowed <sup>4</sup>T<sub>2</sub> → <sup>4</sup>A<sub>2</sub> transition. For x = 0.0, the emission maximum is located at ~820 nm and shifts to ~920 nm with increasing indium content, consistent with a reduction of crystal field strength due to lattice expansion. Excitation spectra exhibit a UV band related to host absorption and two characteristic Cr<sup>3+</sup> transitions (<sup>4</sup>A<sub>2</sub> → <sup>4</sup>T<sub>1</sub> and <sup>4</sup>A<sub>2</sub> → <sup>4</sup>T<sub>2</sub>), which also shift with increasing x, confirming the weakening of the crystal field. Temperature-dependent measurements reveal typical thermal broadening of the emission band. The x = 0.0 sample shows the highest thermal stability, maintaining emission up to 420 K and retaining about 50% intensity at 500 K, whereas indium-containing samples exhibit significant quenching around 350 K. Luminescence decay measurements were performed for all compositions, spectroscopic results will be presented separately to further elucidate the relationship between structure and optical properties.

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