

The effect of annealing temperature on structural and optical properties of $\text{ZnGa}_2\text{O}_4:\text{Cr}^{3+}$ synthesized by citrate sol-gel method

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This paper reports the material properties of Cr^{3+} (1 mol %) doped ZnGa_2O_4 nano-powder prepared by citric acid assisted sol-gel method. The effect of annealing temperature on optical, structural and morphological properties of $\text{ZnGa}_2\text{O}_4:\text{Cr}^{3+}$ (1mol %) nano-sized particle were investigated. The x-ray diffraction (XRD) results showed that the synthesized nano particles are cubic structured and the annealing temperature did not affect the crystal structure. The average crystallite size of $\text{ZnGa}_2\text{O}_4:\text{Cr}^{3+}$ was observed to increase from 11.85 nm to 30.88 nm as the annealing temperature increased from 600 to 1000 °C. The analysis of high resolution transmission electron microscope (HR-TEM) show that with increase of annealing temperature the average particle size increase and also the HR-TEM image show clear lattice fringe which is indicative of increase in crystallinity

with increase in annealing temperature. Ultraviolet-visible (UV-Vis) spectrophotometer measurement shown an increase in reflectance in visible region and also energy band gap found to be increase with increase of annealing temperature. The photoluminescence (PL) intensity was found to be maximum with sample annealed at high temperature (1000 °C) and least with sample annealed at low temperature (600 °C). An increase in annealing temperature leads significantly increment in PL intensity. The degree of crystallinity also increased with annealing temperature from XRD, SEM and HR-TEM analysis. The emission spectra, photoluminescence lifetimes and particle size are comparable with reports on bio imaging applications.

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