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Excitation Dependent Luminescence in Cr^{3}+ Doped $MgAl_2O_4$ Nanocrystals

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Abstract : The ligand field dependent visible as well as NIR emission of the Cr^{3}+dopant in spinel hosts has attracted immense attention in tuning the color emitted by the material. In this research, Mg1-xCrxAl_2O_4(x=0.5, 1, 3, 5, and 10 mol%) nanocrystals have been synthesizedby solution combustion method. The synthesized nanocrystals possessed a single phase cubic structure. The strong absorption by host lattice defects (antisite defects, F centres) andd-d transitions of Cr^{3}+ ions lead to radiative emission in the visible and NIR region, respectively. The red-NIR emission in photoluminescence spectra inferred the octahedral symmetry of Cr^{3}+ ions and anticipated the site distortion by the presence ofCr^{3}+ clusters and antisite defects in the vicinity of Cr^{3}+ ions. The thermoluminescence response of UV and γ-irradiated Cr doped MgAl2O4 samples revealed the formation of various shallow and deep defects with doping Cr^{3}+ions. The induced structural cation disorder with an increase in doping concentration caused photoluminescence quenching beyond 3 mol% Cr^{3}+ doping. The color tuning exhibited by Cr doped $MgAl_2O_4$ nanocrystals by varying Cr^{3}+ ion concentration and excitation wavelength find its applicability in solid state lighting.

Keywords : antisite defects, cation disorder, color tuning, combustion synthesis
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