Active Research:

Sol-gel synthesis, magnetic and luminescent properties of Zinc-sulphide, Zinc-oxide nanoparticle phosphors doped with manganese (II) ions. As well as nanocomposite materials of ZnO-ZnS, ZnO-PbS & ZnS-PbS. These materials are important in solar cell technology, gas sensors, light emitting devices, etc. The research is aimed in contributing towards the future of green energy sources.

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Abstract

Nanoparticle phosphors were prepared by adding orange emitting Mn^{2+} ions as activators to a host matrix of ZnS nanoparticles. The compounds of ZnS:Mn exhibited radiative energy transfer of the 500 nm band to band luminescent centres upon the introduction of Mn^{2+} ions, this was observed when the concentration of the dopant was $\geq$ 0.5 mol % that of the host. A prominent orange-yellow emission at 600 nm associated with the electronic transitions in Manganese ($^6A_1 \rightarrow {}^4T_1, {}^4T_1, {}^4E$) resulted. The intensities of these emissions were inversely proportional to Mn concentration. Postulated mechanism to account for transitions in ZnS and Mn, and subsequent energy transfer between ZnS and Mn were discussed. All the Mn activated and non-activated ZnS nanoparticles in this study had a hexagonal crystal structure with no evidence of additional phases. The energy band gaps acquired from the sample's diffuse reflectance, decreased with an increase in dopant concentration which was indicative of the fact that there is a direct energy transfer between the semiconductor-excited states and the 3d levels of Mn ions. The sample's topography was analyzed using transmission/scanning electron microscopy.

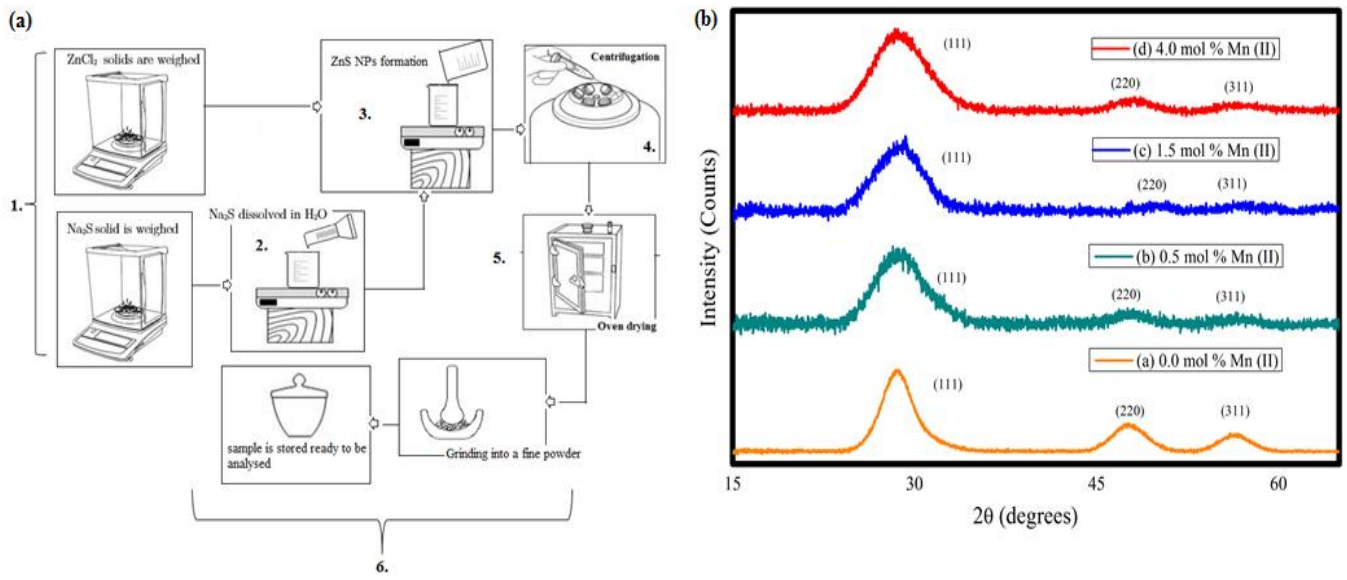

Figure.1: Synthesis flow diagram (a) and phase identification using X-ray diffraction (b).

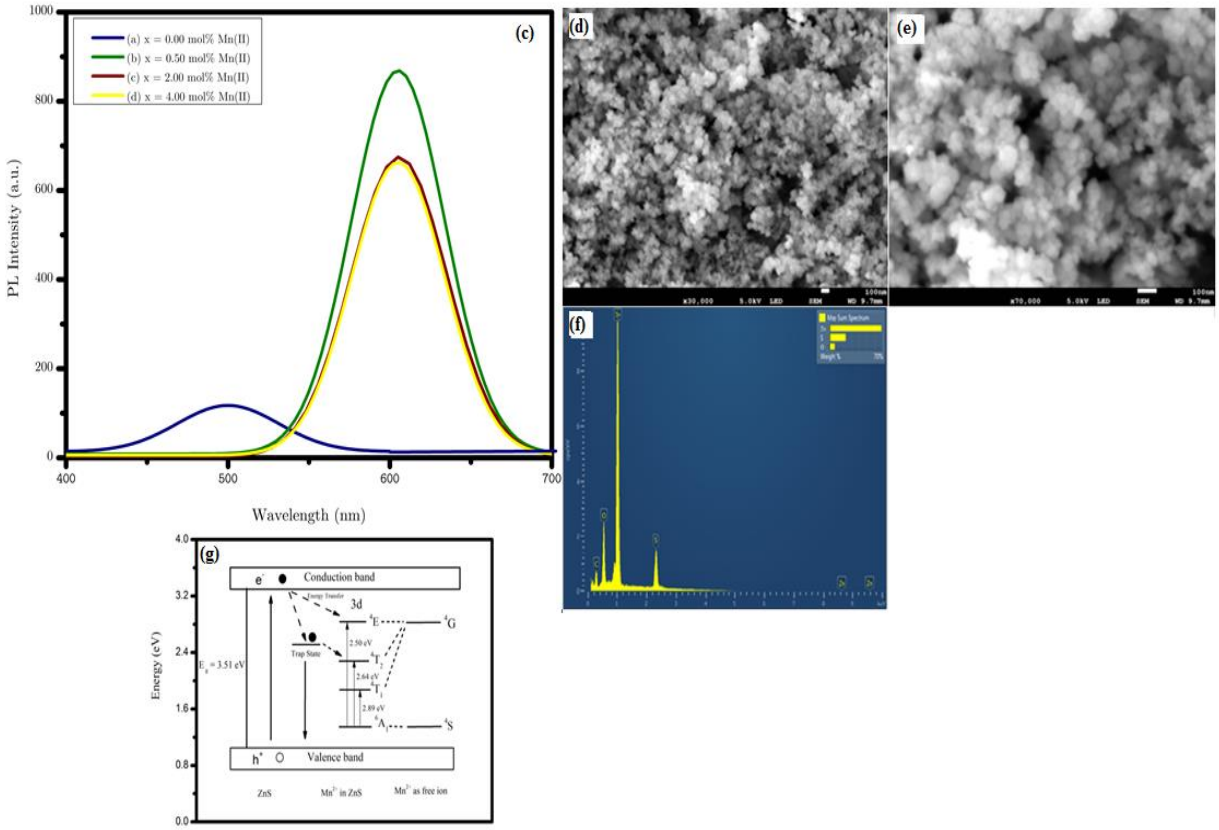

Figure.2: Light emission spectrum (c), particulate morphology in (f) & (e), chemical surface analysis (f) and the efficient energy transfer mechanism (g).