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# Room Temperature Electron Spin Resonance and Raman Study of Nanocrystalline Zn(1-x)Cu(x)O (0.005 < x < 0.05) Synthesized by Pyrophoric Method

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**Abstract :** Owing to the important potential applications over decades, transition metal (TM: Mn, Fe, Ni, Cu, Cr, V etc.) doped ZnO-based diluted magnetic semiconductors (DMS) always attract research attention for more and newer investigations. One of the interesting aspects of these materials is to study and understand the magnetic property at room temperature properly, which is very crucial to select a material for any related application. In this regard, Electron spin resonance (ESR) study has been proven to be a powerful technique to investigate the spin dynamics of electrons inside the system, which are responsible for the magnetic behaviour of any system. ESR as well as the Raman and Photoluminescence spectroscopy studies are also helpful to study the defects present or created inside the system in the form of oxygen vacancy or cluster instrumental in determining the room temperature ferromagnetic property of transition metal doped ZnO system, which can be controlled through varying dopant concentration, appropriate synthesis technique and sintering of the samples. For our investigation, we synthesised Cu-doped ZnO nanocrystalline samples with composition Zn1-xCux ( 0.005< x < 0.05) by pyrophoric method and sintered at a low temperature of 650 0C. The microwave absorption is studied by the Electron Spin Resonance (ESR) of X-band (9.46 GHz) at room temperature. Systematic analysis of the obtained ESR spectra reveals that all the compositions of Cu-doped ZnO samples exhibit resonance signals of appreciable line widths and g value ~ 2.2, typical characteristic of ferromagnetism in the sample. Raman scattering and the photoluminescence study performed on the samples clearly indicated the presence of pronounced defect related peaks in the respective spectra. Cu doping in ZnO with varying concentration also observed to affect the optical band gap and the respective absorption edges in the UV-Vis spectra. FTIR spectroscopy reveals the Cu doping effect on the stretching bonds of ZnO. To probe into the structural and morphological changes incurred by Cu doping, we have performed XRD, SEM and EDX study, which confirms adequate Cu substitution without any significant impurity phase formation or lattice disorder. With proper explanation, we attempt to correlate the results observed for the structural optical and magnetic behaviour of the Cu-doped ZnO samples. We also claim that our result can be instrumental for appropriate applications of transition metal doped ZnO based DMS in the field of optoelectronics and Spintronics.

**Keywords :** diluted magnetic semiconductors, electron spin resonance, raman scattering, spintronics.
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