OPTICAL STUDIES ON (Co, Cu)–DOPED ZnO NANO PARTICLES SYNTHESIZED BY SOL-GEL METHOD AT DIFFERENT CALCINATION TEMPERATURES

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In this work, nanoparticles of zinc oxide doped with cobalt and copper (Zn1-xMxO, M = Co, Cu) with x = 0.03 at. % were synthesized by the sol-gel method using metal nitrates as initial reagents and calcined at a temperature of 773, 823 and 873 K. The crystal structure, crystal size (calculated using the Scherrer equation) and lattice parameters by Rietveld refinement for the synthesized materials was determined by X-ray diffraction (XRD). The local structure and magnetic behavior were studied by electronic paramagnetic resonance (EPR) at low temperatures. The electron transitions and the gap (using the Kubelka-Munk equation) were determined by ultraviolet-visible spectroscopy with diffuse reflectance. The XRD results showed that all the synthesized materials (including zinc oxide, ZnO) exhibited wurtzite type structure, with nanometric crystal size and the lattice parameters are within the values reported by the literature. By EPR were found superficial defects associated with vacancies of zinc and oxygen for zinc oxide samples. The local structure of the doped materials was also studied, in which all the doped samples have a local configuration in axial symmetry, where the substitution by the cobalt and copper atoms in the sites of the zinc atoms in the crystalline structure, respectively. The magnetic behavior of the samples was also studied, showing that all cobalt samples showed ferromagnetic coupling. In the case of samples doped with copper, samples synthesized at 773 and 823 K showed antiferromagnetic coupling, while the sample calcined at 823 K exhibited ferromagnetic coupling. The UV-Vis spectra showed d-d transitions of the Co and Cu metals in the prepared samples. The gap values of zinc oxide were higher than those reported for the doped samples. Given their studied properties, zinc oxide materials doped with cobalt and copper are potential candidates to be used as photocatalysts in the removal of compounds harmful to the environment.

Keywords: GAP, WURTZITE, SOL-GEL METHOD

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