

(Research Article 5)

Magnetic properties of chromium-doped ZnO

Authors: *T. A. Abd-Elbaset, Yue-Wen Fang, Chun-Gang Duan and Mahmoud Abdel-Hafiez.*

Published in: *Journal of Superconductivity and Novel Magnetism, 29 (2016) 1937.*

Impact factor : *1.1*

ISSN: *1557-1939*

Cr doped ZnO was synthesized by using a low-temperature co-precipitation technique producing $Zn_{1-x}Cr_xO$ nanoparticles. The effects of the Cr concentration (0, 0.03, 0.05, and 0.07) on the structural, optical, and magnetic properties of ZnO were investigated by first-principles calculations, X-ray diffraction, Scanning Electron Microscope, the optical spectroscopy (UV - Vis) and magnetization measurements. The results show that Cr atoms are substituted for Zn ions successfully. The Cr ions exhibited +3 valence state other than +2 valence state, which is supported by the fact of high-spin configurations of Cr ions in the first-principle calculations. X-ray diffraction confirms that the samples have a single-phase wurtzite structure with the main crystal size decreases with increasing dopant concentration. This decrease occurs due to the small ionic radius of Cr ions in compared to Zn ions. The morphology on the surface shows further that the samples had a spherical shape with an average particle size of 75 nm. The optical band gap of ZnO nanoparticles varies with Cr doping, which is attributed to the s-d and p interaction. Introducing Cr into ZnO induces a strong magnetic moment.