Effect of Co doping on structural and magnetic properties of ZnO

Shalendra Kumar[1]*, Young Joo Kim[1], S. K. Sharma[2], B. H. Koo[1] and Chan Gyu Lee[1]

[1]School of Nano and Advanced Materials Engineering, Changwon National University, # 9 Sarim-dong, Changwon- 641-773, Republic of Korea
[2]Instituto de Fisica Gleb Wataghin, Universidade Estadual de Campinas (UNICAMP) Campinas, 13.083-970, SP, Brazil,
*Corresponding author: shailuphy@gmail.com

In the recent years there has been a significant interest in the development of the room temperature ferromagnetic semiconductors for spintronic applications due to its high Curie temperature above 300K as predicted by theoretical calculations. One of the materials class to realize this function is the dilute magnetic semiconductors (DMSs) where ferromagnetism and semiconductivity gives an additional degree of freedom and functionality for engineering unique device with applications ranging from non volatile memory to quantum computing. In DMS materials, ZnO based DMSs are particularly promising due to their large band gap, large exciton binding energy (60 meV) over the other conventional wide band gap semiconductors (such as GaN) and lot of potential technological applications in various fields such as: spintronics, light-emitting diodes, UV detectors, laser diode cosmetics and biomaterials. In the present, we have reported structural and magnetic properties of chemically synthesized powder samples of $Zn_{1-x}Co_xO$ with x= 0.01 and 0.03. The effect of Co doping has been studied using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), field cooled (FC) magnetization and magnetic hysteresis loop measurements. From the XRD pattern, it is observed that all the samples have polycrystalline nature with wurtzite and exclude the formation of any impurity phase. From the XRD and FTIR data for different Co concentrations show clear evidence that Co ions are occupying Zn position in ZnO matrix. The magnetization measurements demonstrated that all the samples exhibit ferromagnetic ordering at room temperature.