Effective Mass Model Supported Band Gap Variation in Cobalt-Doped ZnO Nanoparticles Obtained by Co-precipitation

© K.P. Misra[1], S. Jain[1], A. Agarwala[2], N. Halder[1], S. Chattopadhyay[1,¶]

[1] Department of Physics, School of Basic Sciences, Manipal University Jaipur, Dehmi Kalan, Jaipur, Rajasthan, India 303007
[2] Department of Chemistry, School of Basic Sciences, Manipal University Jaipur, Dehmi Kalan, Jaipur, Rajasthan, India 303007

¶ E-mail: the_saikat@yahoo.com

Received June 1, 2019
Revised July 26, 2019
Accepted October 18, 2019

$Zn_{1-x}Co_xO$ $(x = 0.0, 0.01, 0.03, 0.05)$ nanoparticles were synthesized using co-precipitation method. Shift in peaks of XRD patterns for 2θ values has been observed. The changes in 2θ value for different peaks for different samples are studied systematically. Dislocation densities (δ) for the samples are calculated and correlated with observed shift in 2θ values for all the samples. UV-Vis study has been performed to understand the effect of cobalt doping on optical band gap. The band gap shows a cubic variation with dopant concentration (x). The nature of band gap variation has been explained and supported by effective mass model. Samples are also characterized by SEM and EDX to understand the surface morphology and elemental composition.

Keywords: ZnO, band gap, effective mass model, nanoparticle, dislocation density, co-precipitation.

Full text of the paper will appear in journal SEMICONDUCTORS.