Contribution ID: **234** Type: **Poster Presentation**

Structure, optical and magnetic properties of combustion synthesized Ni-Cr doped ZnO

Structural, optical and magnetic properties of combustion synthesized $Zn_{0.96}Ni_{0.01}Cr_{0.03}O$ and $Zn_{0.90}Ni_{0.05}Cr_{0.05}O$ have been investigated. X-ray diffraction (XRD) analyses confirm that samples are in the hexagonal wurtzite structure. No impurity peaks where detected in $Zn_{0.96}Ni_{0.01}Cr_{0.03}O$, while a weak secondary spike $ZnCr_2O_4$ phase ($2\Theta = 43^o$) was identified in $Zn_{0.90}Ni_{0.05}Cr_{0.05}O$. Lattice parameters, obtained from Rietveld refinement, were found to be a=b=3.2535±0.0002 Å for both the samples, while c=5.2132±0.0003 Å for $Zn_{0.96}Ni_{0.01}Cr_{0.03}O$ decreasing to 5.2129±0.0002 Å for $Zn_{0.90}Ni_{0.05}Cr_{0.05}O$. These values are comparable with the standard data (PDF#36-1451). Diffuse reflectance spectra show weak absorption bands at 422, 610 and 660 nm, characteristic of tetrahedral Ni^{2+} ions in the ZnO lattice [1]. Band-gap values, calculated using the Kubelka–Munk function [2], was found to be 3.287±0.003 and 3.272±0.003 eV for $Zn_{0.96}Ni_{0.01}Cr_{0.03}O$ and $Zn_{0.90}Ni_{0.05}Cr_{0.05}O$, respectively. Magnetization as a function of field measurements, $M(\mu_0 H)$, was performed at room temperature using a vibrating sample magnetometer. The $Zn_{0.96}Ni_{0.01}Cr_{0.03}O$ and $Zn_{0.90}Ni_{0.05}Cr_{0.05}O$ samples show ferromagnetic (FM) and antiferromagnetic (AFM) behaviour, respectively. Point defects are the source for the obtained FM in $Zn_{0.96}Ni_{0.01}Cr_{0.03}O$. The exchange interaction between Ni^{2+} and/or Cr^{3+} dopants and formation of a $ZnCr_2O_4$ phase is responsible for AFM behaviour in $Zn_{0.90}Ni_{0.05}Cr_{0.05}O$. This study reveals that the Ni^{2+} and Cr^{3+} ions successfully substituted into Zn^{2+} sites at lower concentrations of Cr^{3+} ions, while at higher concentrations some of the Cr ions are in an octahedral rather than tetrahedral coordination causing the formation of secondary phase. Interestingly, in Ni-Cr doped ZnO, the weak FM behaviour is transformed to AFM behaviour depending on the Cr content.

Keywords: ZnO, Combustion synthesis, Rietveld refinement, Magnetic properties

References

1. J.J. Beltrán, C.A. Barrero and A. Punnoose, The Journal of Physical Chemistry C., Vol. 120, p.8969–8978(2016).
2. N. Srinatha, K.G.M. Nair and Basavaraj Angadi, Physica B., Vol. 474, p.97–104 (2015).

Apply to be considered for a student ; award (Yes / No)?

No

Level for award;(Hons, MSc, PhD, N/A)?

N/A

Primary author: Dr HANDALAGERE SHANKARAPPA, Lokesha (University of Johannesburg)

Co-authors: Prof. SHEPPARD, Charles (Department of Physics, University of Johannesburg); MOHANTY, Pankaj (University of Johannesburg); PRINSLOO, Aletta (University of Johannesburg)

Presenters: Dr HANDALAGERE SHANKARAPPA, Lokesha (University of Johannesburg); PRINSLOO, Aletta (University of Johannesburg)

Session Classification: Poster Session

Track Classification: Track A - Physics of Condensed Matter and Materials