

## Defect-induced room temperature ferromagnetic properties of the Al-doped and undoped ZnO rod-like nanostructure

Jule L  
Dejene F  
Ali AG  
Roro KT  
Mwakikunga BW

### ABSTRACT:

In this work, electron paramagnetic resonance (EPR) experiment on undoped ZnO and Al doped ZnO (AZO) nanoparticles prepared by facile sol–gel method were investigated. The effects of the Al concentration on room temperature ferromagnetic (FM) properties of the AZO ( $Zn_{1-x}Al_xO, 0.1 \leq x \leq 0.30$ ) are reported. EPR signal reveals the origin of FM is purely intrinsic and related with interaction of clusters carrying net magnetic moment coming from electron spin trapped in defect states. Increasing Al concentration results in reducing FM ordering which are likely due to reduction in amount of oxygen adsorption. Defect analysis based on PL, indicates zinc interstitials ( $Zn_i$ ) and singly oxygen vacancies ( $Vo^+$ ) are responsible for mediating ferromagnetism in the undoped ZnO. The assertion was supported by Raman spectra and EPR analysis. Moreover, the present work suggests the potential applications of AZO in future spintronics and speculate the origin of ferromagnetism in AZO nanoparticles.