Contribution ID: **489** Type: **Poster Presentation**

Understanding the fundamental properties of 1D Co3O4-ZnO nanofibers for enhanced gas sensing performance

Semiconductor metal oxides are widely recognized as effective materials for gas sensing due to their ability to detect gases at trace levels, high sensitivity, and low production cost. Among various strategies to enhance their performance, heterostructures combining n-type and p-type semiconductors have proven particularly effective. In this study, cobalt oxide (Co3O4)-doped zinc oxide (ZnO) nanostructures synthesized via electrospinning exhibit promising fundamental properties for gas sensing applications. The doping process significantly modifies the ZnO matrix, enhancing its surface area, electrical conductivity, and catalytic activity. Furthermore, the p-n heterojunctions formed between n-type ZnO and p-type Co_3O_4 facilitate efficient charge carrier separation, leading to improved sensor response and enhanced gas sensing performance.
One-dimensional (1D) nanostructures, such as electrospun fibers, offer distinct advantages in gas sensing. Their high surface-to-volume ratio provides abundant active sites for gas adsorption, while their continuous pathways ensure efficient charge transport and rapid diffusion of gas molecules. These properties make 1D nanostructures particularly suitable for achieving high sensitivity and selectivity in practical sensing environments.
To comprehensively understand the fundamental properties of Co3O4-ZnO nanofibers, various characterization techniques will be employed. X-ray diffraction (XRD) will confirm crystalline structure and phase composition; scanning electron microscopy (SEM) and transmission electron microscopy (TEM) will reveal fiber morphology; photoluminescence (PL) spectroscopy will highlight defect states; UV-Vis spectroscopy will assess bandgap changes; Raman spectroscopy will analyze vibrational modes; and X-ray photoelectron spectroscopy (XPS) will provide insights into chemical states. These analyses will enable a deeper understanding of how structural and optical properties influence gas sensing performance.
This study highlights the potential of Co3O4-doped ZnO nanofibers as high-performance materials for advanced gas sensors, through the combined advantages of semiconductor heterostructures and 1D nanostructures for enhanced functionality.

Apply for student award at which level:

None

Consent on use of personal information: Abstract Submission

Yes, I ACCEPT

Primary author: NKUNA, Khanyisile (University of the Witwatersrand)

Co-authors: SHINGANGE, Katekani; ERASMUS, Rudolph (University of the Witwatersrand, Johannesburg); Dr MOKHENA, Teboho (Mintek)

Presenter: NKUNA, Khanyisile (University of the Witwatersrand)

Session Classification: Poster Session

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