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Wide band gap ZnO nanostructures: Tailoring of defect concentrations for ferromagnetic and gas sensing properties in materials

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Metal oxides such as zinc oxide (ZnO), etc. has attracted a lot of research interest due to their wide direct band-gaps, which are useful for a variety of applications in light emitting diodes, gas sensors, solar cells, etc. Recently, the renewed interest in nanostructured ZnO has been driven by its attractive prospects for applications in room temperature (RT) nano-lasers, p-type doping, and RT ferromagnetic semiconductor nanomaterials for spintronic applications. This developing field of spintronic materials that combine both semiconducting and ferromagnetic properties has generated a widespread attention due to its potential to provide new functionalities and enhanced performance in conventional electronic devices. Thus, in this contribution we give present an overview on nanostructural effect of ZnO materials for spintronics, gas sensing and solar cells applications. In this rather puzzling diluted magnetic semiconductor (DMS) topic of ferromagnetism origin, by controlling the synthesis method using sol-gel, hydrothermal, spray pyrolysis or physical vapour deposition, etc., we establish a direct correlation between ferromagnetism, gas-sensing and the relative concentration of defect-related emissions on the ZnO surface. Furthermore, we also show that mechanical milling (MM) improves the magnetic and sensing properties of metal oxides (e.g. TiO₂, etc.), since MM is a well-known solid-state powder process involving welding and fracturing of particles in a high energy milling process.

Biography

David E Motaung is a Senior Research Scientist at the DST/CSIR Nanotechnology Innovation Centre, National Centre for Nano-Structured Materials, Council for Scientific and Industrial Research in Pretoria, South Africa. His current research interests include fabrication and characterization of nanostructure materials (organic and inorganic) and their application in photovoltaic solar cells, gas sensor and spintronics devices.

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