Synthesis and Characterization of Zinc Oxide Nanostructures

A thesis submitted in partial fulfilment of the requirements for the award of the degree of

Master of Technology

in

Nanoscience and Technology

By

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(2K12/NST/22)

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Certificate

This is to certify that the work entitled "Synthesis and Characterization of Zinc Oxide Nanostructures" is submitted in partial fulfillment of the requirements for the award of degree of Master of Technology in Nanoscience and Technology at the Department of Applied Physics, Delhi Technological University. It is further certified that no part of thesis has been submitted to any university for the award of any other degree.

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Abstract

Zinc oxide nanostructures were synthesized by a wet chemical route using precursors zinc acetate dihydrate and potassium hydroxide and capping agents ethylene glycol (EG) and ethylenediamine (EDA) in ethanol/water solvents. The nanostructures consist of nanoparticles, nanorods and nanoflowers. Structural and morphological characterization of the nanostructures was performed using X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM). The optical properties of the synthesized nanostructures were also investigated using UV/Vis and Photoluminescence (PL) spectroscopy. Results show that the nanoparticles calcinated at 450°C deagglomerate when recalcinated at a higher temperature and the particle shape becomes spherical. The hexagonal wurtzite structure as confirmed by the XRD patterns is unchanged after the sample is recalcinated. Defects-related states are also eliminated at a higher temperature of 750ºC and UV emission is observed at 359nm. The nanorods synthesized using EDA at 450ºC are short with a length of around 300nm and results reveal that increasing the calcination temperature to 600ºC reduces the aspect ratio. PL spectrum results show the existence of two bands, UV emission due to free excitonic recombination and blue emission due to defect states. The ZnO nanoflowers synthesized using EDA with a growth time of 6hrs consist of self-assembled bullet-shaped nanorods. The absorption spectrum shows a peak at 264nm due to the quantum confinement effect and the PL spectrum exhibits near-band edge emission at 360nm and the defect-related band at 430nm.

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