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Investigation of the structural, optical and gas sensing properties of Aluminum doped zinc -oxide nanoparticles synthesized by solvo-thermal method

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Abstract: In this research, semiconductor nanoparticles of Aluminum doped zinc oxide (AZO) were synthesized using zinc nitride as a precursor and ethylene-glicol as complexing agent with Aluminum molar ratio of 0, 2, 4, 6, 8 and 10% by solvo-thermal method. Crystal structure and surface morphology of the samples were studied by X-ray diffraction analysis (XRD), Field Effect Scanning Electron Microscopy (FESEM) and Tunneling Electron Microscopy (TEM). XRD Results describes the Hexagonal wurtzite structure of zinc oxide with preferred peaks corresponding to (100), (001), (101), (102), (110) and (103) planes. Also by increasing of Aluminum concentration, the preferred peaks shift to higher angles, hence lattice constants have a decreasing trend. While, nano-crystallite sizes have an increasing trend and the sizes were found between 17.5 to 25.2 nm. FESEM and TEM images show that increase of Aluminum concentration causes increase of the nanoparticles size. The optical band gap of the samples was found between 2.03 to 2.66 eV. By increasing Aluminum content from 0 to 4%, band gap decreases and then increases for higher concentrations from 4 to 10%. Investigation of the Acetone gas sensor properties for the sample of 4% impurity shows that maximum response time is for 2300 ppm density which is 60 s and the minimum is 42 s for 3600 ppm.

Keywords: *ZnO nanoparticles; Aluminum impurity; gas sensing; solvo-thermal.*

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