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Synthesis and Characterization of Ni doped ZnO Nanoparticles

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Abstract. In this paper, we present synthesis of L-valine assisted surface modification of Ni doped ZnO nanoparticles (NPs) using chemical precipitation method. Samples were calcined at 500°C for 2h. Uncalcined and calcined samples were characterized by powder X-ray diffraction (XRD), transmission electron microscopy (TEM) and ultraviolet-visible (UV-vis) spectroscopy. Ni doped ZnO NPs with average particle size of 8 nm have been successfully obtained using L-valine as surface modifying agent. Increase in the particle size was observed after the calcination. XRD and TEM studies confirmed the purity, surface morphology and hexagonal wurtzite crystal structure of ZnO NPs. UV-vis spectroscopy indicated the blue shift of excitons absorption wavelength and surface modification by L-valine.

Keywords: ZnO nanoparticles, L-valine, XRD, TEM, UV-vis.

INTRODUCTION

Nanostructured materials offer great advantages over bulk materials owing to enhanced properties due to high surface to volume ratio and quantum size effects. Semiconducting nanomaterials are known to have peculiar shape and size dependent physical, chemical, electrical and optical properties which can be engineered as per application requirements [1]. ZnO is an interesting wide band gap semiconducting material having room temperature band gap of 3.3 eV and high exciton binding energy of 60 meV. It has got technological importance because of its high mechanical and chemical stability, good optical and thermal properties in addition to its natural abundance and non-toxicity [2, 3]. Doping in ZnO nanostructures are being studied widely for many practical applications like spintronics devices, light emitting diodes, diode lasers and nonlinear optics [4–9]. Authors have reported physical, chemical as well as nonlinear optical properties of undoped ZnO thin films [10] and ZnO thin films doped with Zr, Ce, Mn, F, Er, Al, Sn, F:In [11-16] deposited using various techniques.

In this study, we have synthesized Ni doped ZnO NPs stabilized by L-valine. Samples were calcined at 500°C for 2h in order to remove organic material. Samples were then characterized by ultraviolet-visible (UV-vis) spectroscopy, X-ray diffraction (XRD) and transmission electron microscopy (TEM). The results are presented here.

EXPERIMENTAL

Chemical co-precipitation technique has been invoked for the synthesis of Ni doped ZnO NPs. All chemicals of analytical reagent grade were used as received without further purification. Zinc chloride ($ZnCl_2$) 99.99% purity, sodium hydroxide pellets (NaOH) 99 %, ethanol AR were procured from SD-fine Chemicals, Mumbai. L-valine and

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