Doped and undoped ZnO/PEG Nanoparticles: An Optical Study

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Abstract:

Semiconductor nanoparticles particularly of II-VI class have been the subject of intense studies over last decade primarily due to their interesting size dependent electronic and optical properties. Compared to bulk materials, the variation in the properties of nanoparticles arises mainly from the increase in surface-to-volume ratio and drastic change in the electronic structure due to quantum confinement with decreasing particle size. As an important wide-band-gap semiconductor, ZnO has a band-gap-energy of 3.37 eV at room temperature [1]. ZnO nanoparticles have received great attention for the fabrication of optical and electronic semiconductors due to high surface to volume ratio, superior photoluminescence properties. The ZnO nanoparticles find applications in UV-lasers [2]. The luminesence properties can be tuned in the same host semiconductor by introducing dopant ions such as Mn^{2+}, Co^{2+}, Cu^{+2}, Eu^{+2} etc.

In present study, we have synthesized doped (Mn^{2+}, Co^{2+} and Cu^{+2}) and undoped ZnO nanoparticles by simple chemical method using polyethylene glycol-400 (PEG-400) as a capping agent. The synthesized nanoparticles have been characterized by different techniques like X-ray Powder diffraction (XRD), Energy Dispersive X-ray analyses (EDX), Transmission electron microscope (TEM), UV-visible absorption, photoluminescence (PL), Fourier Transform Infrared (FTIR) spectroscopy and Dynamic light scattering (DLS). TEM analysis of undoped ZnO nanoparticles showed that nanoparticles were of size about 100 nm.

The PL study showed that sharp emission band at 400 nm was obtained in undoped and doped ZnO nanoparticles. The synthesized ZnO nanoparticles can be employed in the fabrication of nanoscale optical devices.

References

[1] S. Monticone, R. Tufeu, A. V. Kanaev, J. Phys. Chem. B, **102** (1998) 2854.

[2] M. H. Huang, S. Mao, H. Feick, H. Yan, Y. Wu, H. Kind, E. Weber, R. Russo, P. Yang, Science, **292** (2001) 1897.

Figure

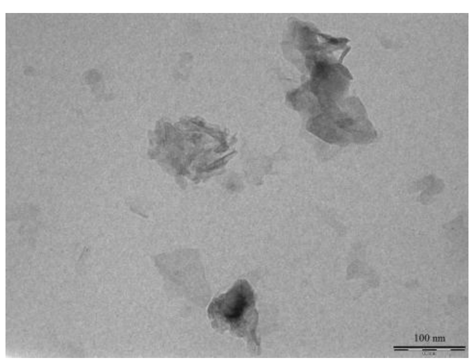

Figure 1. TEM image of undoped ZnO nanoparticles.