Structural, optical and electrical properties of ZnS nanoparticles affecting by organic coating

Abstract

In this study the influence of the organic polymeric coating and its concentration on the structural, optical and electrical properties of ZnS nanocrystals has been investigated. In this matter, PVP-capped ZnS nanocrystals were prepared by a simple, rapid and energy efficient microwave method. The XRD results confirmed the formation of single phase cubic nano crystalline structure. TEM images showed the formation of well isolated spherical nanoparticles with the average size of less than 5.5 nm. The presence of tensile strain in all samples was determined from Williamson-Hall analysis. The elemental compositions of Zn, S and O were quantitatively obtained from EDX analysis, where the FT-IR spectra confirmed coordination with O atoms of PVP. The band gap and absorption edge shift was determined using UV–visible spectroscopy. The PL spectra of the PVP-capped ZnS nanoparticles appeared broadened from 370 to 500 nm due to the presence of multiple emission bands attribute to the sulfur and zinc vacancies or compounded effect of PVP. The electrical property study of samples indicated the conductivity enhancement from 2.981×10-6 to 7.014 ×10-6 S/m by increasing PVP concentration. Increasing of dielectric constant and decrease in the peak value of tan δ by raising the PVP concentration were observed.

Keyword: ZnS nanoparticles; PVP; Williamson-Hall analysis; Photoluminescence; AC and DC conductivity; Dielectric constant