Influence of exposure time on structural, optical and electrical properties of zinc sulphide nanoparticles synthesized by microwave technique

ABSTRACT

Zinc sulphide (ZnS) nanoparticles were synthesized via simple, rapid and energy efficient microwave technique. The obtained nanoparticles were found to possess a cubic structure with an average particle size of less than 5 nm. By changing the microwave irradiation time from 5 to 30 min, the average size of nanoparticles increased and a broader size distribution was obtained. The degree of crystallinity also increased with increasing irradiation time and reached to maximum at 25 min and then fell by rising further the irradiation time. The absorption spectra of prepared ZnS nanoparticles revealed a blue shift in the band gap energy with respect to the bulk counterpart owing to the quantum confinement effect. The photoluminescence study showed the emission intensity increased with increasing the irradiation time up to 25 min due to the increment in crystallinity of the obtained nanoparticles. Further study indicated that the microwave irradiation time has also influenced the electrical properties of nanoparticles, so that the DC conductivity increased from 1.08×10-6 to 1.67×10-4 S/m for irradiation time of 5-25min and decreased to 1.74×10-6 S/m for further irradiation time at 30 min. The dielectric constant showed a power law dispersion with no observed peak for all samples with different irradiation times.

Keyword: Crystallinity; Dielectric constant; General conductivity; Irradiation time; Microwave; Photoluminescence; ZnS nanoparticles