

Structural, Optical, and Electrical Studies of Sonochemically Synthesized CuS Nanoparticles

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In this study, we reported facile sonochemical synthesis of CuS nanoparticles by using CuCl₂ and Na₂S in aqueous medium without using any organic solvent and surfactant. Structural characterization of synthesized product using X-ray diffraction study revealed the formation of hexagonal structure of CuS in covellite phase. Crystallite size of ~ 13 nm and ~ 11 nm were determined using Debye–Scherrer and Williamson–Hall methods, respectively. Field emission scanning electron microscopy micrographs revealed the particulate morphology of CuS nanostructures. The optical properties of CuS nanoparticles were investigated by ultra violet & visible (UV–Vis), photoluminescence (PL), and Fourier transform infrared spectroscopy. The band gap was calculated by Tauc's relation and found to be 3 eV. The PL spectrum showed a strong green emission at wavelength 505 nm. The electrical conductivity of CuS nanoparticles was found to be in semiconducting range, i. e. 550 S/cm. Impedance analysis of CuS nanoparticles revealed 7.55 MHz as the resonant frequency.

Keywords: CuS nanoparticles, sonochemical synthesis, impedance spectroscopy, band gap, electrical conductivity.

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