

Influence of tartaric acid concentration on structural and optical properties of CuSe nanoparticles synthesized via microwave assisted method

ABSTRACT

The influence of chelating agent on structural and optical properties of copper selenide nanoparticle has been the subject of ongoing debate in copper selenide based material research. In this project we developed a straightforward microwave irradiation technique for the synthesis of copper selenide nanoparticles. Copper selenide nanoparticles were successfully synthesized using $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$ and Na_2SeO_3 as copper and selenium sources respectively while, the reducing and chelating agents were hydrazine hydrate and tartaric acid respectively. The effect of concentration of tartaric acid on structural and optical properties of CuSe NPs were investigated. The as-prepared product were characterized by means of an X-ray diffraction (XRD), transmission electron microscopy (TEM), field emission scanning electron spectroscopy (FESEM), atomic force microscopy (AFM), energy dispersive X-ray spectroscopy (EDX), Fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), UV-visible absorption spectroscopy (UV-Vis.), Raman spectroscopy and photoluminescence spectroscopy (PL). XRD results reveal a hexagonal (Klockmannite) crystal structure with size in the range between 73.10 nm and 16.10 nm. The band gap of the as-prepared CuSe NPs were found to increase between 1.80 eV and 2.10 eV. The wavelength of the maximum PL emission was at 600 nm with 400 nm excitation wavelength. Three characteristics vibrational modes belonging to CuSe NPs were detected in the Raman spectra. Therefore, the results obtained in this study provide a new pathway of understanding the effect of tartaric acid concentration on structural and optical properties of CuSe NPs and can explain the use of this novel product as a potential candidate for optoelectronic and solar cell applications.

Keyword: Copper selenide; Nanoparticles; Microwave; Energy band gap; Chelating agent; Tartaric acid