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X-ray investigation of MnS nanocrystals

Manganese sulfide (MnS) is an important semiconductor material due to its optical, electric, and magnetic properties combination and potential applications in solar cells as a window/buffer material, optoelectronic devices, and electrode material. It is well known that bulk MnS has three different crystal structures: stable α -MnS, metastable β -MnS, and γ -MnS structures. Nanosized MnS had attracted growing interest for this material in last time also. Depending on the nanocrystals (NCs) preparation thermodynamic conditions it is possible to obtaine NCs with different morphologies and crystal structures.

However, there are few studies to investigate the influence of the solvent type on the morphology and phase structure of MnS NCs. Using a wet chemical pattern we investigated the influence of solvents nature (aqua and polar organic substances) on the crystal structure of the MnS NCs in our work. Manganese acetate ($\text{Mn}(\text{CH}_3\text{COO})_2$), and Sodium sulfide ($\text{Na}_2\text{S}\cdot 9\text{H}_2\text{O}$) with different solvents such as acetone, ethanol, and ethylene glycol (EG) were used for the synthesis.

The phase structures of the as-prepared product were investigated using the powder X-ray diffraction (XRD), energy-dispersive spectrometer (EDS), and atomic force microscopy (AFM). Optical properties were investigated by photoluminescence spectra (PL).

The conducted studies confirmed the significant influence of the solvent nature on the crystalline structure of the obtained nanoparticles, and confirmed the formation of γ -MnS or β -MnS or a mixture of two modifications with different parameters of the crystal lattice [1].

[1] Zhang J. et al.: Solvothermal synthesis of manganese sulfides and control of their phase and morphology. J. Mater. Res. Vol.33, Issue 24 (2018). P.4224-4232.

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