"Nanocomposites and nanomaterials"

Synthesis of quaternary Cu_2FeSnS_4 nanocrystals via solid-state route: Up-scalable and low-cost fabrication of a challenging material for photovoltaic cells

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Quaternary semiconductor nanocrystals provide promising alternatives to conventional photovoltaic materials because of environmental acceptance (application of S instead of toxic Se), cheapness and availability (application of earth-abundant Fe, Zn and Sn instead of scarce In and Ga). For example kesterite (CZTS) and stannite (CITS) combine many advantageous characteristics for photovoltaic applications, such as composition from the abundant and non-toxic elements, suitable band gap, high absorption coefficient and high radiation stability.

Stannite Cu_2FeSnS_4 has been recently prepared by several techniques such as solution-based, hot injection and microwave irradiation. However, these techniques are complex, time-consuming, need high temperature and toxic organic solvents. In this study we demonstrate the use of precursors in form of elements (Cu, Fe, Sn, S) to obtain CITS by a solid state one-pot mechanochemical synthesis. In this processing route, the unique nanostructures and properties are developed [1].

Methods of XRD, SEM, EDS, HRTEM, Raman, UV-Vis, magnetic and specific surface area measurements were applied. CITS polymorphs with tetragonal body-centered structure and crystallite sizes 17-19 nm were obtained. The new magnetic properties were also documented. The obtained results confirm the excellent structural properties of synthesized Cu_2FeSnS_4 nanocrystals.

1. *Baláž P.* Mechanochemistry in Nanoscience and Minerals Engineering // Springer, Berlin Heidelberg-2008.