NOVEL ORGANO-COLLOIDAL SYNTHESES OF DIFFERENT Sb_2S_3 NANORODS NANOBARS AND NANOWIRES POWDERS WITH SUITABLE BAND GAPS FOR PHOTOVOLTAIC APPLICATIONS

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Sb_2S_3 is a V-VI direct band gap binary semiconductor which has shown a remarkable performance in all solid sensitized cell configurations. High absorption coefficient and other properties exhibited by this material make it a potential candidate for thin film deposition. We reported growth and self-assembly of antimony trisulfide (Sb_2S_3) amorphous nanospheres to nanowires /nanobars /nanorods via a simple, low-cost and modified colloidal synthetic method in organic media. The obtained stable powders of Sb_2S_3 nanowires /nanobars /nanorods have suitable direct band gaps for photovoltaic applications. The band-gap energies of the Sb_2S_3 nanowires /nanobars /nanorods are found to be from 1.35 to 1.6 eV for all the samples observed. Indeed, with energies close to 1.4 eV their band gap energies are appropriate for efficient solar to electrical energy conversion and perhaps could be used in thin film solar cells based on direct mid band gap semiconductors. It was observed that Sb_2S_3 nanospheres self-assembly in wires/rods formation. The optical direct band-gap energy found for amorphous Sb_2S_3 nanospheres was ~1.5 eV. The refinement showed that Sb_2S_3 powders belong to the orthorhombic type with space group *Pbnm* (no. 62) and that Sb_2S_3 nanowires /nanobars / nanorods grow along the [010] direction. We performed photoluminescence (PL) spectroscopy measurements as an equally important and nondestructive tool for evaluating the optical nature of the materials. No peaks were observed either in PL emission or excitation spectra for a broad spectral range, typical for this material. In order to obtained *I-V* characteristics of the Sb_2S_3 synthesized powders very simple PEC solar cell was made (ITO glass/*n*-Sb_2S_3/ 0.5M (KCl+KI) +0.01M I_2/ gold coated silicon plate). Exponential growth of the *I-V* curve after illumination reveals that the cell can work as a generator of electricity, taking into account the fact that the thermal conductivity of the Sb^{3+} is anomalously low and nearly temperature independent.